DOCUMENT RESUME

ED 365 544 SE 053 997

AUTHOR Huntsinger, Carol S.; Jose, Paul E.
TITLE Ethnic Differences in Mathematics Teaching Styles: Chinese-American and Caucasian-American Mother-Father-Daughter Triads.
PUB DATE Mar 93
NOTE 38p.; Paper presented at the Annual Meeting of the Society for Researc. in Child Development (60th, New Orleans, LA, March 25-28, 1993).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Chinese Americans; Correlation; *Cultural Differences; Elementary School Students; *Females; Grade 5; Grade 6; Intermediate Grades; Interviews; *Mathematics Achievement; Mathematics Education; Multivariate Analysis; *Parent Child Relationship; Questionnaires; *Teaching Styles; Verbal Communication; Whites
IDENTIFIERS *Ethnic Differences

ABSTRACT

Chinese-American girls perform as well as Chinese-American boys at higher levels of mathematics. Caucasian-American girls perform significantly less well than Caucasian-American boys. This study, designed to examine factors involved in this differential, contrasts 25 first generation Chinese-American mother-father pairs and 27 Caucasian-American mother-father pairs guiding their fifth- and sixth-grade daughters in solving math-related computer problems. Caucasian-American parents used more verbal mediation, displayed more emotion, relied more on questioning, used more encouraging and discouraging comments, and focused on the computer monitor less than did Chinese-American parents. Daughters' mathematics achievement test scores and mathematics grades were negatively related to mothers' verbal partipation for Chinese-Americans and to fathers' verbal participation for Caucasian-Americans. (Contains 20 references.) (Author)

Ethnic Differences in Mathematics Teaching Styles: Chinese-American and Caucasian-American Mother-Father-Daughter Triads

Carol S. Huntsinger

College of Lake County

Paul E. Jose

Loyola University Chicago

Presented at the 60th Anniversary Meeting of the

Society for Research in Child Development

March 24-28, 1993

Abstract

Chinese-American girls perform as well as Chinese-American boys at higher levels of mathematics. Caucasian-American girls perform significantly less well than Caucasian-American boys. This study, designed to examine processes involved in this differential, contrasts 25 first generation Chinese-American mother-father pairs and 27 Caucasian-American mother- father pairs guiding their fifth- and sixth-grade daughters in solving math-related computer problems. Caucasian-American parents used more verbal mediation, displayed more emotion, relied more on questioning, used more encouraging and discouraging comments, and focused on the computer monitor less than did Chinese-American parents. Daughters' math achievement test scores and math grades were negatively related to mothers' verbal participation for Chinese-Americans and to fathers' verbal participation for Caucasian-Americans.

Ethnic Differences in Mathematics Teaching Styles: Chinese-American and Caucasian-American Mother-Father-Daughter Triads

Mathematics has been demonstrated to be the academic domain where both Asian superiority and gender differences are most evident (Eccles Parsons, Adler, & Kaczala, 1982; Hyde, Fennema, & Lamon, 1990; Lumnis & Stevenson, 1990; Stevenson, Lee, Chen, Stigler, Hsu, & Kitamura, 1990). Asian-American girls perform as well as Asian-American boys on the SAT-Math; whereas, Caucasian-American girls perform significantly less well than Caucasian-American boys (Moore & Stanley, 1986). While ample evidence exists for the relationship between parental beliefs and children's math achievement (e.g., Eccles Parsons, Adler, & Kaczala, 1982), there is much less empirical evidence linking parental behaviors to math achievement. Existing cross-cultural studies have not addressed whether children's math achievement is related to parents' observed behaviors in math-focused interactions with their children. This study was designed to examine the possibility that parental teaching behaviors may be an important factor in the superior math performance of Asian-American girls relative to Caucasian-American girls. Because the term, Asian-American, encompasses widely diverse ethnicities and levels of acculturation, we have narrowed our focus to first generation Chinese-American parents for this study. First generation Chinese-American parents still strongly embrace the beliefs and values of their native culture (Lin & Fu, 1990).

Early research on teaching behaviors in mother-child dyads showed that ethnicity was the best predictor of maternal teaching (Steward & Steward, 1973). Specifically, Chinese-American mothers provided specific instructions and much positive feedback to their young sons. In addition, Chinese-American mothers

embraced teaching as a very important part of their maternal role and they provided daily directed learning periods for their youngsters. More recent research (e.g., Stevenson et al., 1990) has indicated that the whole Chinese family participates in helping children with schoolwork. Topics of conversation among Chinese parents and children are likely to be school-related.

Literature regarding Caucasian-American parental behaviors suggests that fathers provide more help with math homework (Ernest, 1976; Sherman, 1982) while mothers help more with other subjects (Stevenson et al., 1990). Greater maternal involvement has been associated with higher grades and achievement success of Caucasian-American children (Grolnick & Ryan, 1989). Social interaction has been found to be greater between American (primarily, Caucasian) parents and their children. Topics of conversation are often not related to school.

Because Chinese-American parents have been found to use more formal methods of teaching (Huntsinger & Jose, 1993; Steward & Steward, 1973), we thought that the Chinese-American parents might also rely more on directive statements when helping their children to solve problems. Because men are socially dominant in every society around the world (Eagly & Johnson, 1990) and because men demonstrate superior mental spatial rotation ability (e.g., Maccoby & Jacklin, 1974), we thought that fathers would take the lead in helping their daughters in this interaction.

We expected to find that Chinese-American girls would demonstrate faster solution times for the spatial relations problems and perform significantly better on measures of math achievement, that their parents would rely to a greater extent on directive statements when teaching their children, and that parents' verbal behaviors

would be related to their daughters' math achievement differently in the two cultural groups. Specifically, we thought that Chinese-American mothers' verbal behaviors and Caucasian-American fathers' verbal behaviors would be correlated with their daughters' math achievement.

Method

Sample

Thirty second-generation Chinese-American and 30 Caucasian-American fifth and sixth grade girls were recruited from comparable, well-educated, two-parent families in suburbs north and west of Chicago. (See Table 1). At least one parent in each family held a graduate degree. (See Huntsinger, 1991 for more extensive descriptions of sample characteristics.)

Materials

The Factory--Computer Program. This spatial relationships problem solving program (Kosel & Fish, 1986) was the program used in the parent-daughter computer interaction. A spatial relationships program was chosen because visuospatial ability has been characterized as an important component of mathematics ability (e.g., Tartre, 1990), and one in which Asians and males have demonstrated consistent superiority (Lummis & Stevenson, 1990). It requires the player to replicate a sample product--a square transformed by the use of three machines: punch, rotate, and stripe. The first option allows the student to experiment with the operation of the three machines. The second option, which was not used in this study, allows the student to build a factory. The third option asks students to look at a product and to work backwards to determine the process

used to make the product. The student may select one of three difficulty levels: easy, medium, or hard.

Achievement Test Scores. Achievement test scores from routinely administered fifth grade school achievement batteries were obtained for each subject. Because the children came from at least fourteen different suburban school districts, mathematics composite scores from the following five tests were utilized: Stanford Achievement Tests, SRA, Iowa Tests of Basic Skills, Metropolitan Achievement Tests, and California Tests of Basic Skills. Scores were equalized by using national percentile scores.

Spatial Relations Test. The Spatial Relations portion of the Primary Mental Abilities Test (Grades 4-6) (Thurstone & Thurstone, 1949) measures the ability to visualize the relations between objects and figures rotated in space. The SRT is a group-administered, timed test, in which subjects look at a standard figure and decide which of four alternative figures represents a rotation in a plane of the original figure. PMA Spatial Relations quotients as a function of raw score and chronological age were used in the analyses.

Student Questionnaire. A structured questionnaire about liking of various school subjects, task difficulty of school subjects, parent support, and future educational plans was given to the students. One question was used in this paper: "Indicate how difficult each of the following is for you: art, computers, foreign languages, gym, literature, mathematics, music, science, social studies, writing." Responses were indicated on 5-point Likert scales, with 1 representing "very difficult" and 5 representing "very easy."

Student Interview. The following question from the student interview tapping math expectancies was utilized in this paper: "In elementary school, math is required every year. In high school, you have more choice as to what courses you will take. How many years of math do you think you will take in high school?"

Parent Questionnaire. This instrument contained structured-answer questions about parent background, attitudes toward school subjects, and support for children's achievement. Questions utilized in this paper include: (1) Indicate how difficult each of the following subjects was (is) for you: art, computers, foreign languages, physical education, literature, mathematics, music, science, social studies, writing. (2) What are your child's most recent semester grades in [science, social studies, math, language arts]? Five-point Likert scales were used to answer question 1. Semester grades were computed as follows: A = 4.00, B = 3.00, C = 2.00, D = 1.00, with .5 point added to a grade obtained in an accelerated class. All schools used the traditional A-F marking system.

Apparatus. An Apple IIe computer with dual disk drive and monochrome monitor was utilized for the computer interaction. Girls' interviews were tape recorded using a Panasonic RX-SA60 micro-cassette recorder. A Panasonic SlimlineIV recorder and a RadioShack omnidirectional microphone were used to record parent interviews and computer interactions. Sony audiotapes were used throughout.

Procedure

Data was gathered in the summer and early fall of 1990. Subjects were given a personal information and academic attitudes questionnaire and the Spatial Relations Test from the Thurstones' PMA and were interviewed about their

interests and activities. Expectancies for math and task difficulty of math were taken from questionnaires and interviews that assessed attitudes toward all academic subjects. In addition, both mothers and fathers independently completed questionnaires, which included reports of their children's latest semester grades and national percentile scores from fifth grade achievement tests. After a joint parent interview in their homes, mother-father-daughter triads were asked to solve randomly-generated easy-, medium-, and hard-level problems from Factory, a spatial relationships computer program. All participants were fluent in English, although many of the Chinese-American families spoke Chinese in their homes. Participants were not aware that the primary focus of the study was mathematics.

Each interaction was tape-recorded for later transcription and coding. The parents were asked to sit on either side of their daughter, who was seated at their kitchen or dining room table in front of the computer. The following directions were given for the interaction:

> This program is called "The Factory." There are three machines in this factory--a punch machine, a rotate machine, and a stripe machine. I want you to test the machines first so that you and your parents can learn how they work. That is option #1--"Test the Machines." Then, after you feel comfortable with those machines, I want you to select #3--"Make a Product." There you will copy a product that the program gives you. The final goal is to solve a problem at the hard level. (To the parents) Feel free to help her if you like.

After completing #1, "Test the Machines," the daughter selected #3. She could choose to make an easy, medium, or hard product. The goal was to

eventually replicate a hard level product. Most girls chose the easy level first, followed by the medium and hard levels. The following data were coded through visual observation for each participant and recorded by the researcher during the interaction: (a) demonstrations (mainly gestures showing rotation); (b) orientations to the computer (touching, pointing); (c) looks at child (d) looks at father; (e) looks at mother; (f) laughs; and (g) touches child. It must be noted that behaviors c, d, e, and g which were coded through visual observation by the researcher, were possible for only two participants of each parent-child triad. To establish reliability on the above data, the researcher employed and trained a female teacher, who was uninformed of the research predictions, to code the above behaviors (a-g) through visual observation during seven of the interactions (four Chinese and three Caucasian). Agreement of 70% was established through this process. Several original categories were dropped or combined as a result of the interrater experience. Smiles, for example, were too difficult to code reliably. Some subjects smiled through the whole interaction. Originally the researcher had set up separate categories for pointing to the computer screen, pointing to the keyboard, touching the screen, and touching the keyboard. These four were collapsed into a category called "orientations to the computer." The parents and girls seemed to be oblivious to the audio recording and the experimenter's notetaking during the interaction. Their behavior appeared to be completely spontaneous.

The 30-minute audiotapes were transcribed by the first researcher and two other transcribers. When this task was completed, the researcher listened to all of the tapes to check the accuracy of the transcriptions. The following two times were noted from the tapes: (a) time spent on the combined easy and medium levels, and

(b) time spent on the hard level of Factory. Utterances from the transcriptions of the hard level of Factory were coded using the following scheme: MD = makes directive statement; GI = gives information or explanation; ANSQ = answers question; AQ = asks question; EC = encouraging comment; DC = discouraging comment; ASE = acknowledges statement, or exclaims; RA = reads aloud. (See Figure 1.) The above eight-act system was applied to utterances by each father, mother, and daughter. Each of the categories was tallied for each participant and was normalized by dividing by the duration (number of minutes) of the interaction.

Intercoder reliability was established through employing and training a female college student unaware of the hypotheses to code the verbal data from seven randomly selected interactions. A four-page coding manual was used. Reliabilities of 85% to 100% were achieved through this process. The most troublesome category was EC--encouraging comment. It was necessary to listen to the tone of voice used by the parent or child to determine whether a comment was encouraging. A second listening to the tape clarified the questions that arose.

Because of equipment malfunctions, poor recording conditions, and prior experience with the Factory computer program, the tapes of five Chinese-American triads and four Caucasian-American triads were eliminated from the analyses.

Results

Hypothesis I

Chinese-American girls will demonstrate superior overall math and spatial relations performance and faster processing times on Factory than Caucasian-American girls.

Results. The decision to use ANOVAs to analyze the girls' math achievement, SRT scores, task difficulty of math, and expectancies for math was made because the MANOVA procedure rejected any cases in which there was missing data. Missing values occurred because the achievement test scores came from five different tests; not all tests had separate math applications and number concepts subtests. As predicted Chinese-American girls obtained higher mathematics achievement test scores, higher math grades, and higher spatial relations scores than did Caucasian-American girls. (See Table 2.) Chinese-American girls expected to take more mathematics in high school than did Caucasian-American girls. The difference in solution times for the Factory program approached significance. Chinese-American parent-child triads took an average of 11.48 minutes to get from their first exploration of a program to solution of a hard-level problem; the mean for Caucasian-American triads was 14.19 minutes, $t(45) = -1.58$, $p = .063$.

Moderately strong positive intercorrelations between the Spatial Relations Test scores and the mathematics achievement measures were found-- computation (.35), number concepts (.50), math applications (.43), total math (.47), and semester math grade (.40) -- indicating that math achievement and spatial relations scores were related in these girls.

Hypothesis II

There will be significant ethnicity and gender of parent differences in teaching styles. Chinese-American parents are predicted to rely more on directive statements. Fathers are predicted to take a greater teaching role than mothers in both cultures.

Results. All verbal behaviors are reported in occurrences per minute. Separate MANOVA procedures were used to analyze the parents' verbal behaviors, the daughters' verbal behaviors, the parents' visually coded behaviors, and the daughters' visually coded behaviors. A 2 (ethnicity) x 2 (gender of parent) MANOVA used to analyze parents' verbal behaviors was significant for ethnicity, $F(1, 51) = 6.49$, $p < .0001$. (See Table 3). Caucasian-American parents talked significantly more than Chinese-American parents. Specifically, Caucasian-American parents asked and answered more questions and made greater use of explanations, exclamations, and encouraging and discouraging comments. It is noteworthy that Chinese-American fathers uttered no discouraging comments. Although there was no significant difference in the number of directive statements per minute uttered by parents in the two groups, a greater proportion of the utterances by Chinese-American parents' (35%) were directive in nature as compared to Caucasian-American parents (21%).

Although a main effect was not obtained for gender of parent, significant univariate effects indicated that fathers, as a group, made more directive statements, answered and asked more questions, and exclaimed more than did mothers. (See Table 4.) Fathers also touched and pointed at the computer significantly more often than did mothers, $F(1, 51) = 8.09$, $p < .01$. These findings support the prediction that fathers would take the dominant role in helping their daughters.

A MANOVA analyzing daughters' verbal behaviors was significant for ethnicity, $F(1.51) = 2.19$, $p < .05$. There were two univariate effects. Caucasian-American daughters answered significantly more questions ($M = 1.20$) and made

more discouraging comments (M = .10) than Chinese-American daughters (Ms = .56, .02, respectively), (Fs (1, 51) = 9.08, 8.09, $p < .01$).

Caucasian-American mothers (M = .080) looked at fathers significantly more often than did Chinese-American mothers (M = .031), F (14, 36) = 4.31, $p < .05$. No significant ethnicity differences were found for any of the daughters' visually-coded behaviors.

Hypothesis III

Parental teaching styles in the two groups will be correlated differently with their daughters' math achievement, spatial relations test scores, and math attitudes. Specifically, Chinese-American mothers' verbal behaviors and Caucasian-American fathers' verbal behaviors will be correlated with their daughters' math achievement.

Correlations with Achievement. For Chinese-American girls, Pearson correlations revealed moderate to strong negative relationships (rs (23 to 25) = -.35 to -.55, $p < .05$ to .001) between four measures of the daughter's math achievement and the mother's verbal behaviors. (See Table 5.) The higher the daughter's math achievement, the less the mother talked in the interaction.

For Caucasian-American girls moderate to strong negative correlations (rs (26 to 27) = -.33 to -.59, $p < .05$ to .001) were obtained between all five measures of the daughter's math achievement and the amount her father talked in the interaction. The higher the daughter's math achievement, the less the father talked in the interaction.

The total amount of talking the Caucasian-American girls did was negatively related to their math grades (r (26) = - 43, $p < .05$) and total math achievement test

scores (r (25) = - 49, $p < .01$). Girls with higher math achievement talked less in the interaction. Similar relationships were not found for Chinese-American girls.

Correlations with Task Difficulty of Math. The total number of the Chinese-American father's utterances was negatively correlated with the daughter's estimate of the task difficulty of math (r (25) = -.63, $p < .001$). Fathers of daughters who rated math as easier talked less in the interactions.

The total number of the Caucasian-American mother's utterances was related positively to the daughter's report of the difficulty of math (r (27) = .34, p <.05). Mothers of daughters who rated math as easier talked more in the interactions. A mother's ratings of the task difficulty of math for herself (r (27) = -.45, $p < .01$) and for her daughter (r (26) = -.57, $p < .001$) were negatively related to the amount the father talked in the interaction. The easier the mother thought math was for herself and for her daughter, the less the father talked in the interaction.

Correlations with Spatial Relations. The Chinese-American girls' solution times for the hard level Factory problems were correlated with the number of father's explanations (r (25) = .41, $p < .05$), questions r (25) = .34, $p < .05$), and encouraging comments (r (25) = -.42, $p < .05$). The shorter the solution time for the hard level problem, the less the father explained and questioned and the more he encouraged. Similar correlations were not found for Caucasian-American daughters.

Chinese-American girls' SRT scores were negatively correlated with the number of discouraging comments their mothers made (r (25) = -.37, $p < .05$).

The higher the daughter's SRT score, the fewer discouraging comments the mother made.

For Caucasian-American girls, the number of discouraging comments uttered by the mother was positively correlated with solution time on the hard level of Factory (r (25) = .34, p < .05) and negatively correlated with the daughter's SRT score (r (27)= -.41, p < .05). The longer the solution time, the more discouraging comments the mother made. The higher the daughter's SRT score, the fewer discouraging comments the mother made.

Correlations with Verbal Participation. For Chinese-Americans, the total amount the daughter talked was related similarly to the total amount her mother talked (r (25) = .32, p = .061 and the total amount her father talked (r (25) = .38, p < .05). As verbal participation by the daughter increased, verbal participation by both mother and father increased.

A strong positive correlation was found between the amount the Caucasian-American daughter talked and the amount her father talked (r (27) = .71, p < .0001), while the corresponding correlation between the mother and daughter was non-significant (-.05). The more the father talked, the more his daughter talked.

Discussion

As predicted, Chinese-American girls demonstrated higher math and spatial relations test performance, and higher math expectancies. Chinese-American mother-father-daughter triads demonstrated faster processing times on the Factory computer program.

The teaching style of Chinese-American parents was more directive and quieter than that of Caucasian-American parents. It may have fostered greater

concentration on the problem and faster solution times. Caucasian-American parents tended to rely on directive statements, questioning, and explanation equally.

Fathers in both cultures took the lead in helping to solve the problems. It is possible that fathers took the lead because they were more familiar with computers than were the mothers. Fathers in this study rated computers as easier (M = 3.85) than did mothers (M = 3.05). Daughters indicated that they found computers to be easy (M = 4.20), and none was observed to have difficulty operating the computer. The help given by parents directly related to the problems to be solved, rather than technical aspects of computer operation.

Different dynamics appear to be operating in the two cultural groups. For Chinese-Americans, mother's verbal participation was consistently related to the daughter's math achievement. Chinese mothers appear to have been more attuned to their daughters' problem-solving facility. They talked less in interactions with daughters whose math achievement was higher and more with daughters whose math achievement was lower. Chinese-American fathers' verbal participation was greater with girls who rated math as more difficult. The fathers' role with girls who rated math as easier consisted of more encouragement and less explanation and questioning. Fathers and mothers both appeared to allow their more able daughters to solve the problems with minimal parental input. This is consistent with results obtained by Wagner and Phillips (1992) which demonstrated that fathers took a "hands off" approach with more confident girls. The daughter's total verbal participation was related positively to both mother's and father's verbal participation.

On the other hand, Caucasian-American fathers' verbal participation was consistently related to the daughters' math achievement. The father may have tailored his verbal input to his daughter's facility with math. Fathers gave less help to girls who had higher math scores and more help to girls who had lower math scores. Fathers then tended to let the more able girls solve their own problems. Mothers presented a different picture, however. Mothers talked more in the interactions of daughters who rated math as easier. Mothers may have been the primary facilitators for the more able girls, whereas fathers took the lead role for the daughters who were not as successful with math. The daughter's total verbal participation was strongly correlated with father's verbal participation, but not with mother's. Comments from fathers e.g., "Don't listen to your mother," "Don't you remember that from trig? (to mother) Ha, ha!," and "Mommy can even do this," may partially explain the difference.

The Caucasian-American mother-father dynamics are interesting. The easier the mother thought math was, the less the father talked. Mothers who felt competent at math took a greater role in helping daughters with the problem-solving task. When mothers rated math as more difficult, fathers assumed the greater teaching role. Caucasian-American mothers as a group like math less and rate math as more difficult than do Chinese-American mothers and fathers and Caucasian-American fathers (Huntsinger, 1991). Because greater maternal involvement has been found to be related to the achievement of middle class Caucasian students (Grolnick & Ryan, 1989), it may be that the switch to father for help with mathematics homework has an effect on the daughter's achievement. The fact that Caucasian-American mothers looked at fathers significantly more often than did

their Chinese-American counterparts may indicate that they were looking to fathers for help. The Chinese-American parents had immigrated to the United States for graduate work at United States universities. They were products of a school system which required mathematics each year; the majority of mothers and fathers alike had taken mathematics through the first year of calculus. Caucasian-American parents had been required to take only two years of math in high school. Many women select themselves out of math after the minimum equirements are met (Leder, 1990), and many in this Caucasian-American group had done just that.

Mothers in both groups made fewer discouraging comments in interactions with daughters who had higher spatial relationships ability (SRT score). Caucasian-American mothers also gave more discouraging comments (per minute) in interactions that took longer. This may have reflected the mothers' increasing frustration in interactions with girls who were less visually oriented and who took longer to solve a hard-level problem. An alternative explanation suggests that the discouraging comments may have actually slowed down the problem-solving process. It is notable that the Chinese-American fathers uttered no discouraging comments.

A limitation of this study needs to be noted. The sample was a small highly educated sample of mother-father-daughter triads. Generalizations cannot be made to mother-father-son triads nor to less well-educated groups.

This data suggests that although fathers in both cultures took the lead in this computer problem-solving interaction, it may be mothers in the Chinese-American group and fathers in the Caucasian-American group whose verbal

behaviors are more meaningfully connected to their fifth and sixth grade daughters' math achievement.

References

Eagly, A. H., & Johnson, B. T., (1990). Gender and leadership styles: A meta-analysis. Psychological Bulletin, 108, 233-256.

Eccles-Parsons, J. S., Adler, T. F., & Kaczala, C. M. (1982). Socialization of achievement attitudes and beliefs: Parental influences. Child Development, 53, 310-321.

Ernest, J. (1976). Mathematics and sex. American Mathematical Monthly, 83, 595-614.

Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self-regulation and competence in school. Jounral of Educational Psychology, 81, 143-154.

Ho, H-Z., Zimmer, J., & Wang, C-P. (1990, June). Correlates of math achievement: Cross-cultural comparisons. Paper presented at the annual meeting of the Behavioral Genetics Association, Aussois, France.

Huntsinger, C. S. (1991). Mathematics achievement of Chinese-American and Caucasian-American fifth and sixth grade girls (Doctoral dissertation, Loyola University Chicago, 1992). Dissertation Abstracts International, 52, 5212B.

Huntsinger, C. S., & Jose, P. E. (1993). Cultural and parental influences on children's mathematics attitudes: A test of Eccles' model of child motivation. Unpublished manuscript.

Hyde, J. S., Fennema, E., & Lamon, S. J. (1990). Gender differences in mathematics performance: A meta-analysis. Psychological Bulletin, 107, 139-155.

Kosel, M., & Fish, M. (1986). The factory [Computer Program]. Pleasantville, NY: Sunburst Communications.

Leder, G. C. Gender differences in mathematics: An overview. In E. Fennema & G. Leder (Eds.), Mathematics and gender (pp. 27-59). New York: Teachers College Press.

Lin, C.-Y. C., & Fu, V. R. (1990). A comparison of child-rearing practices among Chinese, immigrant Chinese, and Caucasian-American parents. Child Development, 61, 429-433.

Lummis, M., & Stevenson, H. W. (1990). Gender differences in beliefs and achievement: A cross-cultural study. Developmental Psychology, 26, 254-263.

Maccoby, E. E., & Jacklin, C. J. (1974). The psychology of sex differences. Palo Alto, CA: Stanford University Press.

Moore, S. D., & Stanley, J. (1987). Family backgrounds of young Asian-Americans who reason extremely well mathematically. Johns Hopkins Study of Mathematically Precocious Youth Project. ERIC Document ED 282367.

Sherman, J. (1982). Mathematics, the critical filter: A look at some residues. Psychology of Women Quarterly, 6, 428-444.

Stevenson, H. W., Lee, S. Y., Chen, C., Stigler, J. W., Hsu, C.C., & Kitamura, S. (1990). Contexts of achievement: A study of American, Chinese, and Japanese children. Monographs of the Society for Research in Child Development, 55 (1-2, Serial No. 221).

Steward, M., & Steward, D. (1973). The observation of Anglo-, Mexican-, and Chinese-American mothers teaching their young sons. Child Development, 44, 329-337.

Tartre, L.A. (1990). Spatial skills, gender, and mathematics. In E. Fennema & G. Leder (Eds.), Mathematics and gender (pp. 27-59). New York: Teachers College Press.

Thurstone, L. L., & Thurstone, T. G. (1949). Primary mental abilities test. Chicago: Science Research Associates.

Wagner, B. M., & Phillips, D. A. (1992). Beyond beliefs: Parent and child behaviors and children's perceived academic competence. Child Development, 63, 1380-1391.

Table 1

Background Characteristics of Chinese-American and Caucasian-American Samples

Characteristic	Chinese-American Girls	Caucasian-American Girls
Children		
mean age in years	11.8	12.0
accelerated in 1 or more classes	28	22
public school	30	30
private religious school	0	0
5th Grade	16	13
6th Grade	14	17
only child	3	1
first-born	11	16
middle	6	5
last-born	10	8
mean number of siblings	1.40	1.53
Mothers		
mean educational attainment	17.00	16.93
employed full-time	17	14
employed part-time	3	7
full-time homemakers	10	9
Fathers		
mean educational attainment	19.67	18.27

Note. Variables are reported in frequencies, except for those labeled "mean."

Table 2

Ethnicity Differences in Girls' Math Achievement, Attitudes, and Expectancies

	Chinese-American	Caucasian-American	
	Mean	Mean	*F* Value
Achievement Tests:			
Number concepts	94.7 (4.7)	90.2 (9.4)	4.92*
Computation	93.8 (7.8)	87.5 (14.7)	3.89*
Math applications	93.5 (7.6)	91.5 (10.2)	NS
Total Math	96.0 (4.4)	92.3 (8.8)	3.81*
Math Grades	4.23	3.92	3.70~
Spatial Relations Test	127.4 (14.2)	118.6 (16.2)	5.02*
Difficulty of Math	3.97	3.87	NS
Expected H. S. Math Participation	3.63	2.90	6.71*

Note. National percentile scores were taken from five different achievement tests: Stanford, Iowa, California, SRA, and Metropolitan. Each test battery had a different combination of subtests, resulting in variation in Ns.
~$p < .10$. *$p < .05$.

Table 3

Ethnicity Differences in Parent Verbal Behavior

	Chinese-American		Caucasian-American		
Parent Behavior	N	Mean	N	Mean	*F* Value
Directive Statement	26	1.10 (1.32)	27	1.19 (1.33)	NS
Explanation	26	.625 (.627)	27	1.07 (.866)	7.16**
Asked Question	26	.601 (.627)	27	1.11 (.865)	9.27**
Answered Question	26	.239 (.295)	27	.394 (.451)	3.42~
Encouraging Comment	26	.154 (.217)	27	.460 (.421)	18.98***
Discouraging Comment	26	.011 (.054)	27	.076 (.139)	7.69**
Exclamation	26	.515 (.680)	27	.996 (.945)	7.50**
Total Talk	26	3.24 (2.86)	27	5.27 (3.81)	9.70**

Note. Behaviors reported in occurrences per minute.
Standard deveiations reported in parentheses.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 4

Mother-Father Differences in Verbal and Visually-Coded Behaviors During Computer Interaction

	Mothers	Fathers	
Verbal Behavior	Mean	Mean	*F* Value
Directive Statement	.86 (1.40)	1.44 (1.23)	5.18*
Explanation	.667 (.648)	.935 (.992)	3.61~
Asked Questions	.690 (.672)	1.032 (.920)	7.01*
Answered Questions	.218 (.345)	.418 (.429)	9.60**
Encouraging Comment	.257 (.335)	.362 (.404)	2.91~
Discouraging Comment	.061 (.136)	.027 (.094)	2.91~
Exclamation	.591 (.648)	.929 (1.077)	4.52*
Total Talk	3.38 (3.13)	5.17 (3.68)	8.20**
Visually Coded Behaviors			
Touched or pointed at computer	.217 (.218)	.394 (.435)	8.09**

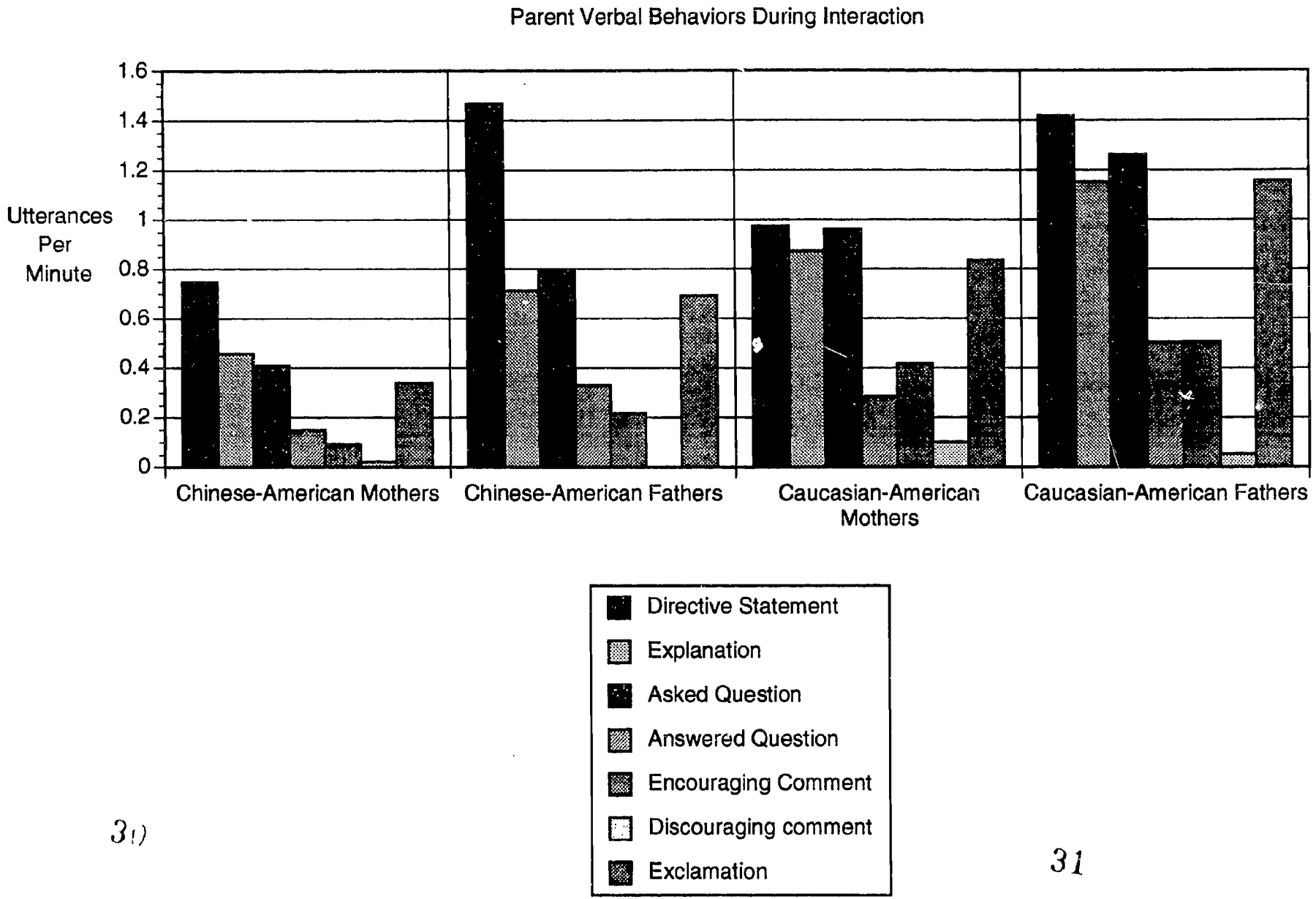
Note. Standard deviations reported in parentheses. Behaviors reported in occurrences per minute. ~$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 5

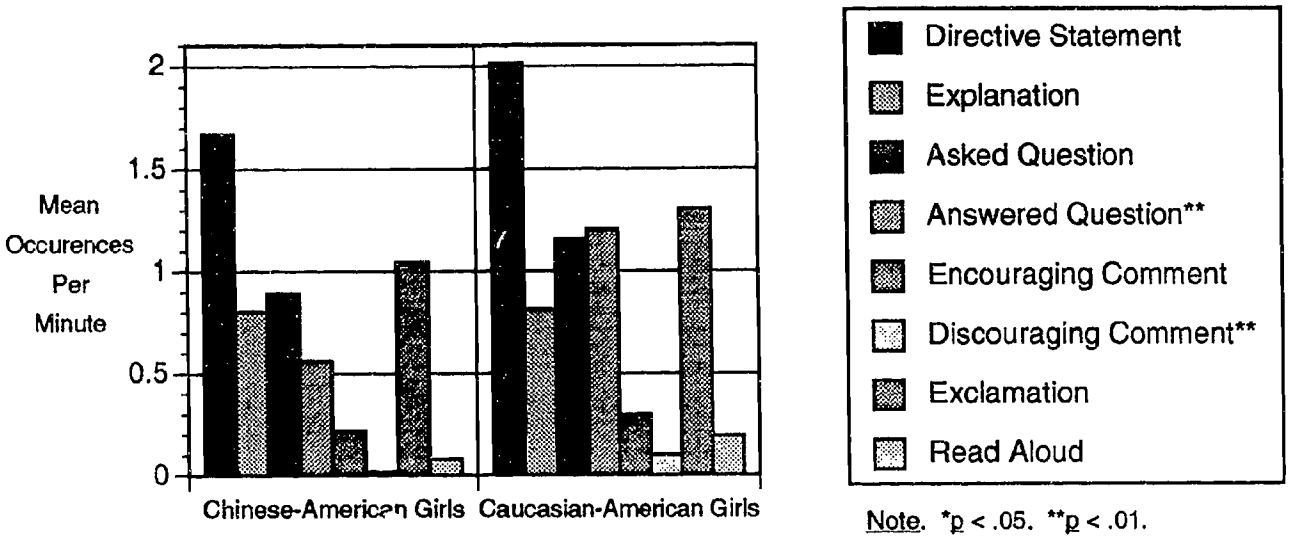
Correlations of Parent Interaction Behaviors with Daughter's Mathematics Achievement and Attitude Measures

	Mom Talk	Dad Talk	Child Talk	Mom Explain	Dad Explain	Mom Encour	Dad Encour	Mom Discour
Total math achievement test	-.35* -.09	.18 -.48**	. 17 -.49**	-.40* .04	-.01 -.48**	-.31 .16	.17 -.23	.17 -.10
Semester math grade	-.48** -.08	-.10 -.33*	-.12 -.43*	-.51** -.01	-.30 -.29	-.23 -.04	.18 -.36*	-.48** -.06
SRT	-.22 -.33*	-.05 -.18	-.07 -.16	-.33 -.19	-.14 -.29	-.20 -.01	.13 -.25	-.37* -.41*
Daughter's rating of the task difficulty of math	.10 .34*	-.63*** .17	-.27 .34*	.03 .38*	-.38* .18	.19 -.06	-.38* -.10	-.35* .36*
Solution time for Factory hard-level problem	.22 -.07	.14 .21	.04 -.19	.16 .13	.41* -.02	.21 .20	-.42* -.28	-.24 .34*

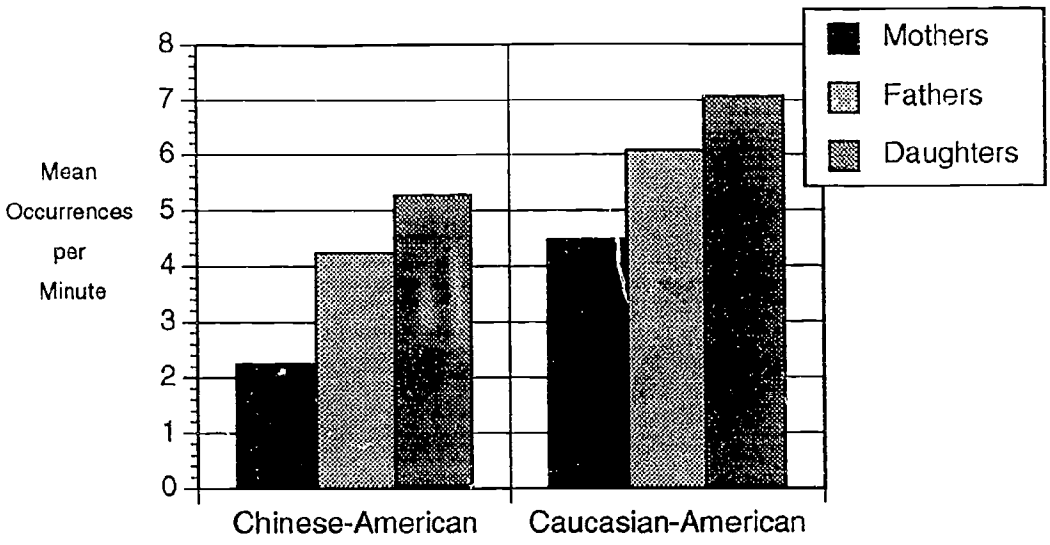
Note. Within each row there are two sets of correlations. The top set contains the correlations for Chinese-American girls. The second set contains the correlations for Caucasian-American girls. Ns = 23-26. Utterances were normalized on occurrences per minute. MomTalk = Total number of utterances that mother made, DadTalk = Total number of utterances that father made, ChildTalk = Total number of utterances child made, MomExplain = Number of explanatory statements that mother made, DadExplain= Number of explanatory statements that father made, MomEncour =Number of encouraging comments that mother made, DadEncour = Number of encouraging comments that father made, MomDiscour = Number of discouraging comments that mother made.
*$p < .05$. **$p < .01$. ***$p < .001$.


Parent Verbal Behaviors During Interaction
Utterances Per Minute
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Chinese-American Mothers
Chinese-American Fathers
Caucasian-American Mothers
Caucasian-American Fathers
Directive Statement
Explanation
Asked Question
Answered Question
Encouraging Comment
Discouraging comment
Exclamation

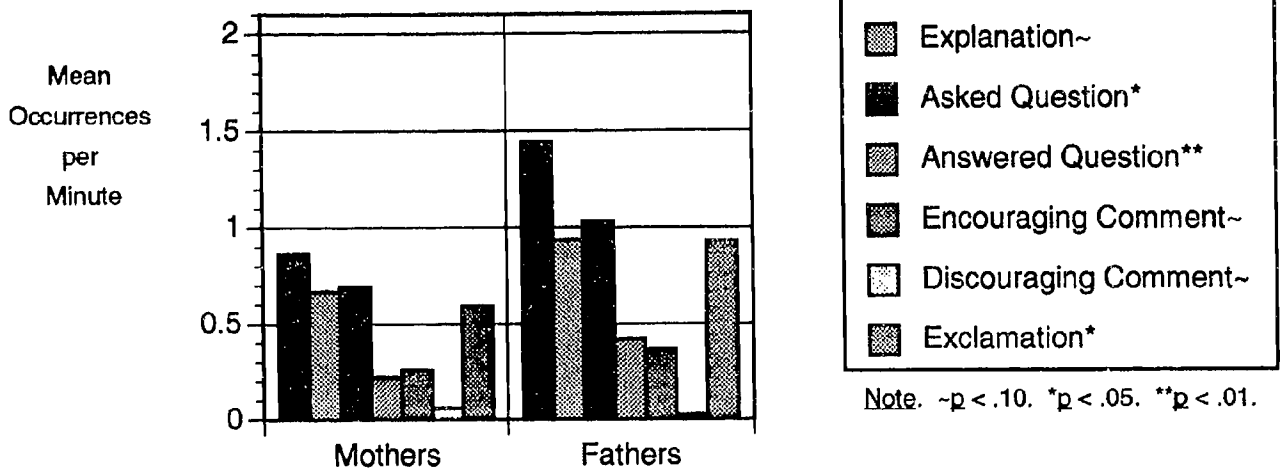
Ethnic Differences in Daughters' Verbal Behaviors



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


Total Utterances of Triad Members
Mothers
Fathers
Daughters
Mean Occurrences per Minute
8
7
6
5
4
3
2
1
0
Chinese-American
Caucasian-American

Gender Differences in Parents' Verbal Behaviors



Note. ~$p < .10$. *$p < .05$. **$p < .01$.

Touched or Pointed at Computer Screen