Parental Influence on Chinese Children's Mathematics Learning

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Abstract

In order to examine parental influences on children's mathematics achievement, a survey participated by 198 students and their parents in fifth-and eighth-grade has been conducted in Hangzhou, China. It was found that parents held very high expectations for their children's education and highly involved themselves in their children's mathematics, irrespective of their educational background and social economic status. Results showed that parental educational expectations for their children and involvement in their children's mathematics learning were two major factors which influence children's educational expectations for themselves, attitudes toward mathematics, and self-confidence in doing mathematics. The research also showed that about 11 % of the variability of mathematics achievement were accounted for by the variability of parental educational expectation for their children, but that parental involvement had less influence on mathematics achievement.

Keywords: Educational expectations, Parents, Students' Attitudes toward Mathematics Learning, Family Factors, children's mathematics achievement, Family background

Background of the Study

It is obvious that many international comparative studies have consistently shown that students in Asia outperformed their peers in the West in mathematics (Robitaille, 1989; Lapointe 1992; Beaton, 1996; Mullis, 1997). Even though China did not join the Third International Mathematics and Science Study (TIMSS), some evidences have shown that Chinese students excelled in mathematics (Lapointe 1992; Stevenson, Lee, Chen, Lummis, Stigler, Fan, & Ge 1990 & 1992; Wong, 1998). Researchers are increasingly interested in exploring Asian students' excellence in mathematics from a variety of different perspectives. For example, it was found that the school year in Asian counties is longer than that in the United States, and that Asian students spent more time on academic study than American students (Stevenson, 1992). Moreover, researches suggested that Asian instructional techniques and curricula facilitated children's mathematics learning (Schmidt, 1999; Ma, 1999; Stigler & Hiegert, 1999). Some researchers have argued that the higher expectations, lower satisfaction, and the attribution of success to efforts in Asian parents seemed to make a difference in Asian students' top-performance in mathematics (Stevenson, 1992; Hess, Chang & McDevitt, 1987). But less attention was paid to explore the explanation for the success of Asian students in mathematics from familial and cultural perspectives. A few studies identified Chinese parents' characteristics as the following: (1) Place emphasis on education; (2) Provide more stable home environments; (3) Assume their duty to instill in their children a good attitude toward the school, and view the home as more responsible for the children's success in mathematics; (4) Hold higher expectations for achievement; (5)Monitor the

children's free time;(6)Attribute children's performance to an internal, controllable source (Chen, 1995; Hess, 1987; Lee, 1996; Leung,1998).

The primary purpose of the study was to investigate how the family influences children's mathematics learning. The relationships of socioeconomic status, parental expectation for their children, parental involvement and children's affective and academic achievement in mathematics were examined within the following framework modified from Chen's framework (Chen, 1995).

A Model of Family Influences on Children's Mathematics Achievement

<table>
<tr><th colspan="2">Family Factors</th><th>Children's Outcomes</th></tr>
<tr><td>Family background</td><td>Books at home
Facilities such as computer</td><td rowspan="2">Educational expectations
Attitudes toward mathematics
Attitudes toward mathematics learning
Self-confidence in doing mathematics
Academic achievement.</td></tr>
<tr><td>Parental factors</td><td>Parental education
Educational expectations
Attitudes toward mathematics learning
Involvement</td></tr>
</table>

According to the findings of previous studies and the stipulation of the above research paradigms, the following hypotheses were formulated:

Parents with high education and high SES (including Parental education, Books at home, Facilities such as computer) would have higher expectations for their children education;

Parents with high education and high SES would have higher involvement in their children's mathematics learning;

Students from high educational background and high SES would have higher expectations for their educational and higher mathematics achievement;

Students from families with high parental expectations would have higher mathematics achievements.

Students from families with high parental involvement would have higher mathematics achievement.

Method

Instrument

In the research, two questionnaires were conducted, one for students and the other for their parents.

The Parental Questionnaire consisted of three sections. The first part measured family background which includes parental education degree, and parental expectations for their children adapted from TIMSS-R students' questions. The second section assessed parental attitudes toward mathematics learning developed by myself according to the literature, and

the last part measured the parental involvement (PI) translated from Parental Involvement Question (Cai, 1999).

The Student Questionnaire consisted of four parts. The first part was an Attitudes toward Mathematics (ATM) scale translated from the Scale for Measuring Attitudes toward Mathematics (Ailen, 1979a). The second part was a Self-confidence Scale in Doing Mathematics (Selfcon) translated from the Self-confidence Scale on Mathematics Learning (Fennema & Sharman, 1976). The third part measured the student's attitudes toward mathematics learning designed by myself, and the last part was modified from Cai's PIQ so that it was suitable for children. Two Ph. D students confirmed the translated version.

The subjects were to answer each of the items, using a 4-point Likert scale. In the survey, Cronbach's coefficient Alpha for PI, for ATM, for Selfcon is .78, .92, and .91 in turn, so PI, ATM and Selfcon are reliable instruments for measuring relevant dimensions.

Subjects

The subjects consisted of 199 students from the fifth and eighth grade in normal primary school and secondary schools. These schools are located in the center of the city, which is an old district of the city with a high proportion of local people. A local researcher (the president of one teacher's school who is also the governor of the district education committee) was responsible for conveniently selecting four classes from two primary schools and two secondary schools, which were somewhat representative in terms of their academic level and demographic distribution.

Data collection

The students' questionnaires were conducted in class within 30 minutes, and were collected by teachers as soon as they were completed. Then students were asked to take the parental questionnaire booklet to their parents, and return it to the teacher after their parents filled it out. Finally, 198 students' questionnaires and 178 parental questionnaires were available for the data analysis (101 students and 96 parents in grade 5, 97 students and 82 parents in grade 8).

Because the grades of primary school students were unavailable, I only analyzed the mathematics achievement in junior high schools, which was the grade of the mid-term test conducted one month after the survey. In order to examine the validity of the score, I also collected the score of final-term test and computed the correlation between two achievements($r = .89$, $p = .000$). This means that taking score of mid-term test as students' achievement, to some extent, is valid.

Results

Family background

The average of parental education is secondary school or vocational schools level. About 24% of the fathers and 18 % of the mothers finished university. More than 16% of the parents had about 200 books at home, but 22 % of the family had less than 25 books at home. Besides, three-fourth of the children had their own room and 45 % of the students had their own computers.

Educational expectations

More than 95 % of the parents hoped their children would finish university or above. It is impressive that over 94 % of the students expect to finish university, and more than 69% of the students hoped to get a master's degree or above.

Parental Involvement (PI)

The 21 items from the PI scale were grouped into five categories according the roles of parents. However, the items were mixed in the PI scale when it was conducted to parents. Some results were summarized as follows.

Parents as Motivators (MO)

Most of the parents consistently provided emotional support for their children's mathematics learning. For example, 94% of the parents responded that at home they encouraged their children to work hard on mathematics problems even though the problems may be difficult. Over 88% of the parents were usually able to motivate their children to learn math well, but 63 % of parents lacked strategies on how to motivate their children to complete math assignment well.

Parents as Resource Providers (RP)

About 98% of the parents felt they have tried hard to have a nice learning environment. 85% of the parents have often bought math-related books, and 55% of parents have asked tutors to help their children's mathematics learning when they were not capable of helping them.

Parents as Monitors (MI)

Over 86% of the parents checked their children's homework regularly, and 77% of them were aware of their children's mathematics requirements by consulting school resources available. But one-fourth of the parents said they seldom spent time talking with their children about their progress in math.

Parents as Mathematics Content Advisors (MC)

Although 80% of the parents made an effort to understand the mathematics their children are studying in school, only 33 % of the parents felt they know enough mathematics to help their children. In addition, 63 % of the parents often discussed with their children how mathematics is used in daily life and 60 % of them felt they could help their children solve problems in math class.

Parents as Mathematics Learning Counselors (ML)

Almost 80% of the parents felt they know their children's strengths and weaknesses in learning mathematics, but over one-third of them do not know the strategies for helping their children overcome their weaknesses. More than 70% of the parents have tried to figure out good approaches for helping their children learn different math topics. Although 84% of the parents have tried to match their expectations with their children's capability, almost half of them were not aware of the approaches their children's teachers were using.

Parents' and Students' Attitudes toward Mathematics Learning

Parental Attitudes toward Mathematics Learning

About 98% of the parents believed that mathematics is important for daily life use, developing logical thinking ability and future career and further study. Almost 94% of them regarded mathematics as an important examination subject. Over 86% of the parents felt mathematics is interesting and like it, although less half of them felt mathematics is difficult to learn. Although over 94 % the parents believed that memorizing the multiplication table is necessary, only one-third of them regarded learning mathematics as almost memorizing. Over 88% of the parents believed "practice makes perfect".

Students' Attitudes toward Mathematics Learning

Just like their parents, about 95% of the students believe that mathematics is helpful for their future career and further study, and important for examination. Although almost half of the students regard mathematics as a set of formula and rules, more than 72 % of them felt that they should enjoy mathematical beauty in mathematics learning and less than one-fifth of them felt that learning mathematics mainly depends on memorizing. More than 92 % of the students believed that memorizing the multiplication table is necessary and "practice makes perfect". 96% of the students believed that math problems can be solved in different ways.

The Attribution of Success in Doing Mathematics

Only less than 10 % of the parents attributed their children's good mathematics performance to lots of natural talent and good luck, but 98% of them believed that doing lots of hard work at home is necessary and about 80% of the parents agreed that memorizing the textbook or notes is useful.

But interestingly, more students (33%) attributed their success in learning mathematics to their natural talent than parents did, and a slightly higher percentage of students (13%) attributed their success in learning mathematics to good luck than their parents did (7%).

Students' Attitudes toward Mathematics and Self-confidence in Mathematics Learning

In general, the students hold positive attitudes toward mathematics. They felt that mathematics is enjoyable (Mean = 19.04, out of 24), important (Mean = 20, out of 24) and that they have the motivation to study more (Mean = 19.42, out of 24). But they are a little in fear of mathematics (Mean = 18.94, out of 24), for example, more than one-fourth of the students felt afraid or anxious when studying mathematics.

Generally, students have self-confidence in doing mathematics. But over 20 % of the students felt anxious when attempting mathematics.

The Relationship between Family Factors and Children's Outcomes

The Relationship among Family Factors

The correlations among family factors are shown in the following table. The most interesting finding was that there are no significant correlations between parental involvement (PI) and each of parental education, books at home, facilities such as computer and parental

educational expectation for their children. It is also surprising that there is a negative correlation between parental involvement (PI) and parental education degree although the correlation is not significant (r = -.026).

Correlations among Family Factors (Pearson Correlation, 2-tailed)

	1	2	3	4	5
1. Average of parents education	1.00				
2. Books at home	.446**	1.00			
3. Facilities such as computer etc. at home	.288**	.312**	1.00		
4. Parental expectations for their Children	.278**	.223**	.016	1.00	
5. Parental Involvement	-.026	.140	.130	1.09	1.00

Note: **correlation is significant at .01 level (2-tailed)

The data imply that all parents highly involve themselves in children's mathematics learning regardless of their educational and economic background.

The Relationships among Children's Affective Outcomes

The correlation analysis revealed that there are high correlations among students' factors. For example, there is a higher correlation between attitudes toward mathematics (ATM) and self-confidence in doing mathematics (SelfCon) ($r=.821$, $p<.001$) and perception of parental involvement makes a great contribution to students' self-confidence in doing mathematics ($r = .452$, $p < .001$).

Stepwise regression analysis showed that parental expectations for their children makes a significant contribution to children's expectations for their education ($R^2 = .268$), and the parental expectation for their children together with parental involvement is significant predictor of attitudes toward mathematics, and Self-confidence in doing mathematics.

It was found that parental expectations for their children and parental involvement together accounted for 11 % of the variance of the self-confidence in doing mathematics.

A one-way MANOVA with parental education degree, books at home, facilities such as computer at home, parental educational expectations for their children and parental involvement as independent variables and children's educational expectations for themselves, attitudes toward mathematics and self-confidence in doing mathematics as dependent variables showed that about 28% of the variability of the children's educational expectation for themselves ($df = 51$, $F = 2.046$, $p = .002 < .01$), about 18 % of the variability of the children's attitudes toward to mathematics ($df = 51$, $F = 1.582$, $p = .031 < .05$) are accounted for by the variability of the all the independent variables. It also was found that only parental educational expectations for their children significantly affect children's educational expectations for themselves ($df = 2$, $F = 20.135$, $p = .000 < .001$), children's attitudes toward

mathematics (df = 2, F = 3.795, p = .026 < .05), and self-confidence in doing mathematics (df = 2, F = 4.519, p = .014< .05).

The Relationship between Family Factors and Children's Mathematics Achievement

Family factors and children's mathematics achievement

The correlative analysis showed that there are significant correlations between mathematics achievement and each of parental educational expectations for their children (r = .368, p = .001) and books at home (r = .313, p = .005), but there is no significant correlation between mathematics achievement and each of parental education (r = .156, p = .182) and facilities such as computer at home (r =. 104, p = .364).

Furthermore, stepwise regression analysis with all family factors as independent variables and mathematics achievement as dependent variables showed that about 11 % of the variability of mathematics achievement is accounted for by the variability of parental educational expectations for their children.

Parental involvement and children's mathematics achievement

It was found unexpectedly that there is a negative correlation between mathematics achievement and parental involvement (r = -0.018, p = .889) although the correlation is not significant.

Partial correlation analysis showed that there are positive correlations between mathematics academic achievement and each of Motivator (r = .791, p = .566) and Resource Provider(r = .069, p = .617) but there are negative correlations between mathematics academic achievement and each of Mathematics Monitor (r = -0.154, p = .262), Mathematics Content Advisor (r = -.099, p = .473) and Mathematics Learning counselor (r = -.804, p = .56) although all the correlations are not significant when family background variables were statistically controlled.

Family factors mediated by children's affective factors influence children mathematics achievement

When taking all family factors and children's affective factors as independent variables, stepwise regression analysis revealed that about 38 % of the variability of mathematics achievement is accounted for by the variability of self-confidence in doing mathematics (df = 1, F = 28.905, p = .000).

Conclusions

Generally, parents believed that mathematics is useful, important and interesting, thus they held positive attitudes toward mathematics. They mostly attributed their children's successful learning in mathematics to controllable factors (exercise and memorizing) rather than to uncontrollable factors (talent and luck). A profile of parents' and students' attitudes toward mathematics and mathematics learning showed that they believed mathematics is interesting, useful, important, and so on. Parents and students all believed "practice makes perfect", stressed memorizing, and attributed success in mathematics learning to efforts. These findings echo those of previous studies. It was found that parents and students held higher expectations for further education, and the parental expectations for their children's education

have modest significant correlation with parents education background and books at home. Parental involvement was not a major predictor for children's mathematics achievement, which again did not support the hypothesis that students from families with high parental involvement would have higher mathematics achievements. Parental expectations for their children strongly predicted children's mathematics achievement and support the hypothesis that students from families with high parental expectations would have higher mathematics achievement. This partly can be explained by Chinese "filial piety" value--namely, that children perceive their parental expectation through parental involvement, and do their best to meet their parental demand under the effect of "filial piety" value. Chinese students who perceived high expectations and care from their parents, endorsed positive attitudes toward mathematics and higher self-confidence in doing mathematics with the beliefs that" practice makes perfect" and "attribute success to efforts". So the students have motivation and persistence to pursue mathematics success although the learning environment may be undesirable.

Recommendations

1. Parents are advised to provide adequate care for their children in order to promote their academic excellence.
2. Chinese students should develop positive attitudes toward mathematics and higher self-confidence in doing mathematics irrespective of their parental care or not. They should have such beliefs that" practice makes perfect" and "attribute success to efforts".
3. They should encourage themselves with motivation and persistence to pursue mathematics success.

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