

Full Length Research paper

A Meta -Analyze on Mathematical Beliefs and Mathematical Performance of Iranian Students

Diana Fardin¹, Hassan Alamolhodaei², Farzad Radmehr^{2*}

¹Faculty of Mathematical Science, Islamic Azad University Science and Research Branch, Tehran, Iran

²Faculty of Mathematical Science, Ferdowsi University of Mashhad, Mashhad, Iran

Accepted 23 April, 2011

The main objective of this study was to investigate the effectiveness of psychological and societal factors on students' mathematical performance and beliefs. A sample 440 girl' students of 9th grade were assessed on a questionnaire with 32 questions. The results indicate that psychological and societal factors such as parents' degrees, jobs, income, attitudes towards mathematics and students' attitudes toward mathematics, attention on mathematical lessons, beliefs about teachers' role on their mathematical understanding, beliefs about the effect of their try on mathematical performance had significant correlation with students' mathematical performance and beliefs. These findings could help provide some practical implications for improving students' mathematical performance.

Keywords: Mathematical beliefs, mathematical performance, societal factors, psychological factors

INTRODUCTION

The beliefs that students and teachers hold about mathematics have been well-documented in the research literature in past decades (e.g., Cooney, 1985; Frank, 1988, 1990; Garofalo, 1989a, 1989b; Schoenfeld, 1987; Thompson, 1984, 1985). Also, much research has been conducted on the essential role of beliefs in learning and teaching mathematics (Thompson, 1992; Richardson, 1996; Philipp, 2007). Students' mathematical beliefs have powerful impacts on their engagement and achievement, especially on problem solving. Students' beliefs about the nature of mathematical knowledge and skills, about mathematical problem-solving, and about their own mathematical capability, often determine their level of attendance and learning (Hassi and Laursen, 2009). Negative attitudes and emotions, together with inadequate self regulatory behaviors, are often connected with students' preventive beliefs and perceptions in mathematics learning situations (DeBellis and Goldin, 2006; Malmivuori, 2001; McLeod, 1992). Such beliefs and behaviors derive from students' previous classroom experiences, both positive and negative; they are highly stable and difficult to change (e.g., Bishop, 2001; Cobb, Yackel and McCain, 2000). The relationship between students' beliefs and societal influences is significant.

The purpose of this study was to answer several questions concerning high school students' beliefs and what influences those beliefs. In particular, researchers were interested in how society influences students' beliefs and whether those influences differ according to the students' level of mathematics studied.

One thing that has not changed in the last few years is the absence of universal acceptance by mathematics education researchers of a definition of beliefs that can ground the various theories. Goldin (2002) defines beliefs as "multiply encoded, internal cognitive/affective configurations, to which the holder attributes truth value of some kind (e.g., empirical truth, validity, or applicability)" (p. 59), and distinguishes among beliefs, warranted beliefs, and knowledge. Others maintain that the absence of consensus around definitions is not necessarily counterproductive, since beliefs constitute a very flexible and accommodating construct. We do not foresee the situation changing soon (Furinghetti and Pehkonen, 2002; Törner, 2002; Goldi et al., 2009).

As Torner (2002) introduced, beliefs have different aspects: Ontological, Enumerative, Normative and Affective one, so a Meta-analyze on mathematics beliefs of Iranian students were considered to investigate the effectiveness of these psychological and societal factors on students' mathematical beliefs:

- Parents' Age, degrees, jobs, income, attitudes towards mathematics and satisfaction from students

*Corresponding author Email: f.radmehr65@gmail.com

- Students' Attitudes toward mathematics, attention on mathematical lessons and Students' mathematical understanding compare to other lessons

- Students' beliefs about teachers' role on their mathematical understanding and beliefs about the effect of their try on mathematical performance

In an attempt to Meta-analyze on mathematical beliefs and mathematical performance the following objectives were sought:

The first objective of the study was to discover whether there would be relationship between mathematical beliefs and students' mathematical performance.

The second objective of this research was to discover whether there would be a relationship between mathematical beliefs, mathematical performance and Parents' Age, degrees, jobs, income, attitudes towards mathematics and satisfaction from students.

The third objective was to discover whether there would be relationship between mathematical beliefs, mathematical performance and Students' Attitudes toward mathematics.

The fourth objective was to discover whether there would be relationship between students' mathematical beliefs, mathematical performance, beliefs about teachers' role on their mathematical understanding and beliefs about the effect of their try on mathematical performance.

The fifth objective was to discover whether there would be relationship between mathematical beliefs, mathematical performance and Students' attention on mathematical lessons.

And the last objective was to discover whether there would be relationship between mathematical beliefs, mathematical performance and Students' mathematical understanding compare to other lessons.

MATERIALS AND METHODS

Participants

Data reported in this paper was collected by a questionnaire administered to 440 girls' students of 9th grade (aged 15-16 years old) who were selected from ten high schools. For this purpose, random multistage stratified sampling design was used. These students were from 6 public general and 4 private general high schools in the district of Tehran in Iran.

Procedures

The research instrument was a questionnaire with 32 questions that gather information about the psychological and societal factors of the students that mentioned above. The questionnaire present in appendix. For 9th

question to 32th question, researchers used a five point Likert-scale from 1 (very low) to 5 (very much). This questionnaire is based on the Arousal theory (Hebb, 1955), Attribution Theory of Achievement Motivation and Emotion (Weiner, 1985), Social Cognitive Theory (Bandura, 1986), locus of control theory (Rotter, 1966) and Vygotsky's social development theory. Also students' mathematic points in 3 year of guidance schools were gathered for measuring their mathematical performance.

RESULTS

As to the first objective of this study, a relationship was found between students' mathematical performance and mathematical beliefs. The Pearson's correlation between these variables was significant (0.21) with p-value less than 0.001. It means that by increasing students' positive beliefs about mathematics students' mathematical performance will be increase, too.

The second objective of this research was to discover whether there would be a relationship between mathematical beliefs, mathematical performance and Parents' Age, degrees, jobs, income, attitudes towards mathematics and satisfaction from students:

Parents' age

Students whom parents was under 40 years old was put in the first group, second group was students whom parents was between 40 and 50 and third group was students whom parents had more than 50 years old. The result of one-way ANOVA for three groups of fathers' age and mothers' age showed that there isn't significant different between these groups in terms of mean scores obtained in Math exam with p-value .614 for fathers and .757 for mothers, nevertheless students' mathematical performance that was in the second group (both for mothers and fathers) was more than two other groups as shown in the figure 1. The result of one-way ANOVA for three groups of mothers' age showed that there is significant different between these groups in terms of mean scores obtained in Mathematics beliefs test with p-value .014. According to graph error bars as can be seen in the figure 2, the superiority of students' mathematical beliefs was in the second group and then first one. The result of one-way ANOVA for three groups of father' age showed that there isn't significant different between these groups in terms of mean scores obtained in Mathematics beliefs test with p-value .0186. According to graph error bars as can be seen in the figure 2, the superiority of students' mathematical beliefs was in the third group and then second one.

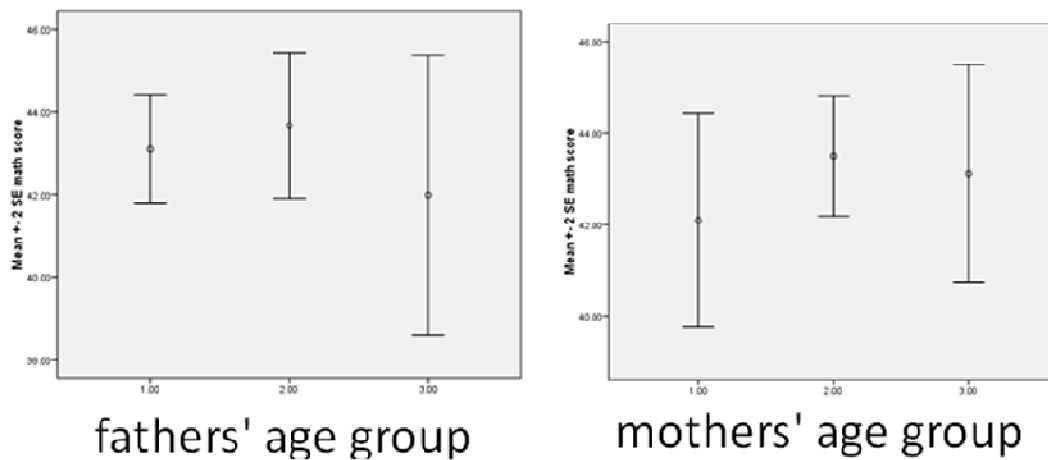


Figure 1. Students' mathematical performance & parents' age

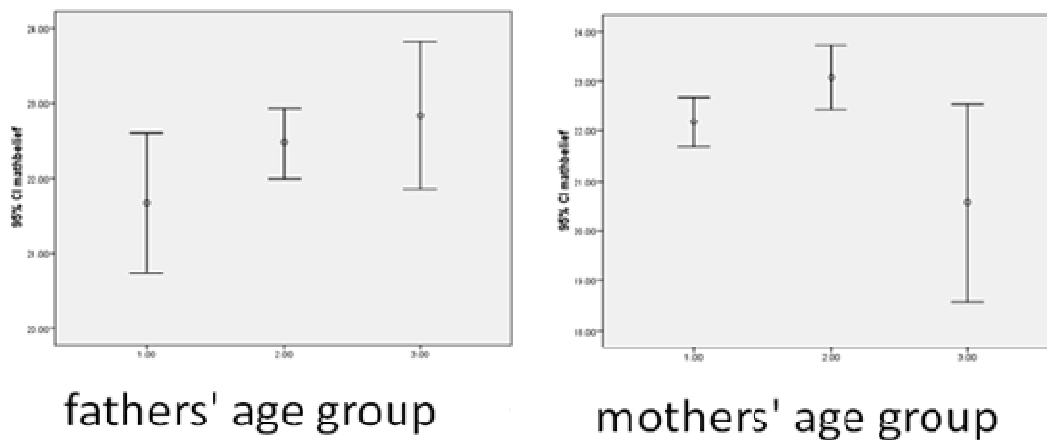


Figure 2. Students mathematical beliefs and parents' age

Parents' degree

Students whom parents' degree was under diploma was put in the first group, second group contained students whom parents' degree was diploma and higher diploma, and third one was students whom parents' degree was Bachelor or higher. The result of one-way ANOVA for three groups of mothers' degree showed that there is significant different between these groups in terms of mean scores obtained in Math exam with p-value less than 0.001. According to graph error bars as can be seen in the figure 3, the superiority of students' mathematical beliefs was in the third group and then second one. Also the result of one-way ANOVA for three groups of fathers' degree showed that there is significant different between these groups in terms of mean scores obtained in Math exam with p-value less than 0.001. According to graph error bars as can be seen in the figure 3, the superiority of students' mathematical beliefs was in the third group and then second one. But the result of one-way ANOVA for three groups of fathers' and mothers' degree showed that there isn't significant different between these group

in terms of mean scores obtain in math beliefs test with p-value= .980 for fathers and p-value= .529 for mothers.

Parents' job

Fathers' job was classified in three groups: first group contained gatekeepers, drivers, workers, farmers, self-employers, second group contained jobholder, military work, medical work and Retired father and third group contained engineer, doctors, university teachers, teachers and Attorney. Also mothers' job was classified in three groups: first one contained Housewife, worker and self-employers, second group contained jobholder, students at university and medical workers and third group contained of doctors and teachers.

The result of one-way ANOVA for three groups of father' job showed that there is significant different between these groups in terms of mean scores obtained in Math exam with p-value less than 0.038. The superiority of students' mathematical performance was in the third group and then second one. But the result of

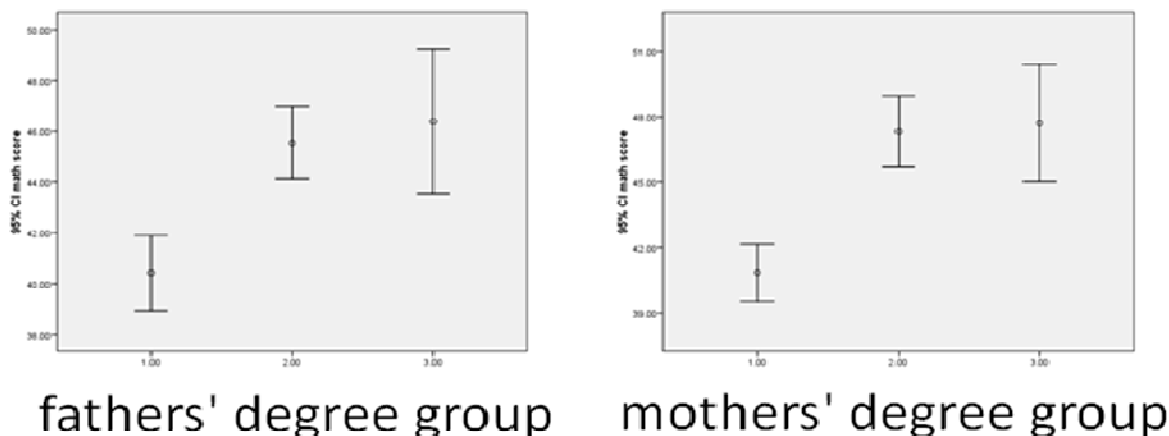


Figure 3. Students' mathematical performance & parents' degree

Table 1: Comparing mathematical performance and mathematical beliefs with Parents' attitudes towards mathematics and satisfaction from students

Subject	P-Value	Pearson's Correlation
Parents' math attitudes & student's math performance	0.035	0.102*
Parents' satisfaction from students & student's math performance	0.623	-.023
Parents' math attitudes & student's math beliefs	Less than 0.001	0.265*
Parents' satisfaction from students & student's math beliefs	Less than 0.001	0.200*

* Correlation is significant at the 0.01 level

one-way ANOVA for three groups of father' job showed that there isn't significant different between these groups in terms of mean scores obtained in Math beliefs test with p-value less 0.942. The result of one-way ANOVA for three groups of mother' job showed that there is significant different between these groups in terms of mean scores obtained in Math exam with p-value less than 0.011. The superiority of students' mathematical performance was in the third group. But the result of one-way ANOVA for three groups of mother' job showed that there isn't significant different between these groups in terms of mean scores obtained in Math beliefs test with p-value less 0.488.

Parents' income

The Spearman's correlation between Parents' income and students' mathematical performance was significant (0.135) with p-value=0.016 but there isn't significant correlation between parents' income and students' mathematical beliefs.

Parents' attitudes towards mathematics

The Pearson's correlation between Parents' attitudes towards mathematics and Students' mathematical

performance was significant (0.102) with p-value=0.035 also there was significant correlation between Parents' attitudes towards mathematics and students' mathematical beliefs (0.265) with p-value less than 0.001 as shown in table 1.

Parents' satisfaction from students

The Pearson's correlation between Parents' satisfaction from students and Students' mathematical performance wasn't significant but there was significant correlation between Parents' satisfactions from students and students' mathematical beliefs (0.200) with p-value less than 0.001 as shown in table 1.

Students' attitudes toward mathematics

As to the third objective ,The Pearson's correlation between Students' mathematical performance and Students' Attitudes toward mathematics was significant (0.225) with p-value less than 0.001 also there was significant correlation between Students' attitudes toward mathematics and students' mathematical beliefs (0.601) with p-value less than 0.001 as shown in table 2 and 3. The fourth objective was to discover whether there would be relationship between students' mathematical beliefs,

Table 2. Comparing student's mathematical performance in psychological and societal factors

Subject	Pearson's Correlation	P-Value
Students' Attitudes toward mathematics	.225*	Less than 0.001
Students' attention on mathematical lessons	.255*	Less than 0.001
Students' beliefs about teachers' role on their mathematical understanding	.284*	Less than 0.001
Students' beliefs about the effect of their try on mathematical performance	.223*	Less than 0.001
Students' mathematical understanding compare to other lessons	-.274*	Less than 0.001

* Correlation is significant at the 0.01 level

Table 3: Comparing student's mathematical beliefs in psychological and societal factors

Subject	Pearson's Correlation	P-Value
Students' Attitudes toward mathematics	.601*	Less than 0.001
Students' attention on mathematical lessons	.335*	Less than 0.001
Students' beliefs about teachers' role on their mathematical understanding	.194*	Less than 0.001
Students' beliefs about the effect of their try on mathematical performance	.374*	Less than 0.001
Students' mathematical understanding compare to other lessons	-.227*	Less than 0.001

* Correlation is significant at the 0.01 level

mathematical performance, beliefs about teachers' role on their mathematical understanding and beliefs about the effect of their try on mathematical performance:

Students' beliefs about teachers' role on their mathematical understanding

The Pearson's correlation between Students' mathematical performance and Students' beliefs about teachers' role on their mathematical understanding was significant (0.284) with p-value less than 0.001 also there was significant correlation between Students' beliefs about teachers' role on their mathematical understanding and students' mathematical beliefs (0.194) with p-value less than 0.001 as shown in table 2 and 3.

Students' beliefs about the effect of their try on mathematical performance

The Pearson's correlation between Students' mathematical performance and Students' beliefs about the effect of their try on mathematical performance was significant (0.233) with p-value less than 0.001 also there was significant correlation between Students' beliefs about the effect of their try on mathematical performance and students' mathematical beliefs (0.374) with p-value less than 0.001 as shown in table 2 and 3.

Students' attention on mathematical lessons

As to the fifth objectives, The Pearson's correlation between Students' mathematical performance and Students' attention on mathematical lessons was significant (0.255) with p-value less than 0.001 also there was significant correlation between students' mathematical beliefs and students' attention on mathematical lessons (0.335) with p-value less than 0.001 as shown in table 2 and 3.

Students' mathematical understanding compare to other lessons

For investigating the sixth objective Pearson's correlation was used. The correlation between Students' mathematical performance and Students' mathematical understanding compare to other lesson was significant (-.274) with p-value less than 0.001 also there was significant correlation between Students' mathematical understanding compare to other lessons and students' mathematical beliefs (-.227) with p-value less than 0.001 as shown in table 2 and 3. It means that students' who have less difficulty in understanding mathematics compare to other lesson, have better mathematical performance and more positive beliefs about mathematics than those who have more difficulty in understanding mathematics.

DISCUSSION

Many researchers report that, there is an assumption that positive mathematical beliefs, attitudes, and feelings will lead to increased mathematical achievement and while this seems like a reasonable proposition (Grootenboer, 2003a, Wilkins and Ma, 2003; Hassi and Laursen, 2009). Also in this study, authors find the same result that students' mathematical beliefs and students' attitude toward mathematics has significant correlation with students' mathematical performance.

Other studies (e.g. Blau, 1999; Teachman, 1987; Alexander and Entwisle, 1996; Amato and Cheadle, 2005) as the same results of this study, report that parents' income influence on students' mathematical performance. Family income contributed to students' academic achievement (Smith et al., 1997) as well as the physical environment and learning experiences in the home (Klebanov et al., 1994). These are the type of parents who would be aware of the importance of furnishing their homes with appropriate learning materials to give it a conducive learning atmosphere. In other words, the students' actions are shaped by his/her social contact with both parents as well as by the financial and human capital available to the child (Hanafi, 2008). These may have played an important part in enhancing students' academic achievement.

A considerable number of studies have investigated the roles that parents play in students' mathematics learning. It has been suggested that parents' involvement has a significant impact on students' attitudes towards mathematics, students' achievement in mathematics (Stevenson and Newman, 1986; Tocci and Engelhard, 1991). The literature on achievement consistently has shown that parent education is important in predicting Students' achievement (Klebanov et al., 1994; Haveman and Wolfe, 1995; Smith et al., 1997). Even though the majority of the literature on parents' education pertains to the direct, positive influence on achievement (Jimerson et al., 1999; Luster et al., 1989), the literature also suggests that it influences the beliefs and behaviors of the parent, leading to positive outcomes for students (Eccles, 1993). The findings of this study are in line with most previous research findings where parents' educational levels are related to students' academic progress (Garasky 1995; Haveman and Wolfe 1995; Lockheed et al., 1989). Parents' educational level has been consistently reported to be highly correlated with academic achievement especially when both parents have high educational level as these parents have the ability to associate educational materials with progress in their children's education (Gorman 1998; Lockheed et al., 1989; Sewell and Hauser 1980; Teachman 1987; Trusty 2000) compared to parents with lower educational level.

Students' beliefs about teachers' role on understanding mathematics and beliefs about the effect of their try on mathematical performance had significant correlation with

students' mathematical performance and beliefs. So math teachers, mathematics educators should pay attention to these items. If math teachers, change students think about the role of their try on their math achievement, students' mathematical performance will be increased as this study shown. Active engagement of students in their own learning processes, with responsibility, collaboration, and creative use of personal resources, is seen to enhance growth of thinking and problem solving (Prince and Felder, 2007) and social skills (Duch et al., 2001; Jordan and Metais, 1997). Promotion of cognitive, affective and social skills in such learning contexts may then be reflected in students' beliefs, experiences, and activities (e.g., Kwon et al., 2005; Smith, 2006). Our findings point to such positive impacts.

The results of this research agree with the idea that beliefs are "a hidden variable in mathematics education" as well as those beliefs and attitudes influence performance and mathematical ability. Hannula (2002) found that attitudes can be changed. Therefore, one of the purposes of instruction must be the appropriate change in students' beliefs and attitudes in order to improve students' mathematical ability. It would be valuable to continue this study in other areas and consider other psychological factors such as math anxiety, students' cognitive style and working memory capacity to discuss with mathematical performance and beliefs.

REFERENCES

- Alexander kL, Entwisle DR (1996). Schools and children at risk. In A. Booth & J. F. Dunn (Eds.), *Family school links: How do they affect educational outcomes?* Mahwah, NJ: Erlbaum. pp. 67-88.
- Amato PR, Cheadle J (2005). The long reach of divorce: Divorce and child well-being across three generations. *J. Marriage Fam.* 67:191-206.
- Bandura A (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice Hall.
- Bishop AJ (2001). What values do you teach when you teach mathematics? In P. Gates (Ed.), *Issues in mathematics teaching* London: RoutledgeFalmer. pp. 93-104.
- Blau DM (1999). The Effect of Income on Child Development. *Review of Economics and Statistics.* 81(2): pp. 261-76.
- Cobb P, Yackel E, McCain K (Eds.) (2000). *Symbolizing and communicating in mathematics classrooms: Perspectives on discourse, tools, and instructional design*. Mahwah, N.J.: Lawrence Erlbaum Associates.
- Cooney TJ (1985). A beginning teacher's view of problem solving. *J. Res. Math. Educ.* 16:324-336.
- DeBellis VA, Goldin GA (2006). Affect and meta-affect in mathematical problem solving: A representational perspective. *Educ. Stud. Math.* 63(2):131-147.
- Duch BJ, Groh SE, Allen DE (2001). Why problem-based learning? In B. J. Duch, S. E. Groh, & D. E. Allen (Eds.), *The power of problem-based learning*. Sterling, VA: Stylus Publishing. pp. 3-11.
- Eccles JS (1993). School and family effects on the ontogeny of children's interests, self-perceptions, and activity choice. In J. Jacobs (Ed.), *Nebraska Symposium on Motivation: Vol. 40. Developmental perspectives on motivation* (pp. 145-208): Lincoln: University of Nebraska Press.
- Frank ML (1988). Problem solving and mathematical beliefs. *Arithmetic Teacher.* 35 (5):32-34.

- Frank ML (1990). What myths about mathematics are held and conveyed by teachers? *Arithmetic Teacher*, 37 (5):10-12.
- Furinghetti F, Pehkonen E (2002). Rethinking characterizations of beliefs. In G. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* Dordrecht: Kluwer. pp. 39–57.
- Garasky S (1995). The effects of family structure on educational attainment: Do the effects vary by the age of the child? *Am. Journal Econ. Sociol.* 54 (1): 89-106.
- Garofalo J (1989b). Beliefs, responses, and mathematics education: Observations from the back of the classroom. *Sch. Sci. Math.* 89:451-455.
- Garofalo J (1989a). Beliefs and their influence on mathematical performance. *Math. Teacher*, 82: 502-505.
- Goldin GA (2002). Affect, meta-affect, and mathematical belief structures. In G. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* Dordrecht: Kluwer. pp. 59–72.
- Goldin GA, Rosken B, Törner G (2009). BELIEFS – NO LONGER A HIDDEN VARIABLE IN MATHEMATICAL TEACHING AND LEARNING PROCESSES. J. Maaß, and W. Schlöglmann (eds.), *Beliefs and Attitudes in Mathematics Education: New Research Results*, 1–18. © 2009 Sense Publishers. All rights reserved.
- Gorman JC (1998). Parenting attitudes and practices of immigrant Chinese mothers of adolescents. *Fam. Relat.* 47(1):73-81.
- Grootenboer PJ (2003a). The affective views of primary school children. In N. A. Pateman, B. J. Dougherty & J. Zilliox (Eds.), *Navigating between theory and practice* (Proceedings of the 27th conference of the International Group for the Psychology of Mathematics Education, Vol. 3, pp. 1-8). Honolulu, HI: PME
- Hanfi Z (2008). The Relationship Between Aspects of Socio-Economic Factors and Academic Achievement. *Jurnal Pendidikan*. 33:95 – 105.
- Hannula MS (2002). Understanding of Number Concept and Self-Efficacy Beliefs in Mathematics. In P. di Martino (Ed.) *MAVI European Workshop MAVI XI, Research on Mathematical Beliefs*, Proceedings of the MAVI-XI European Workshop, April 4-8, 2002, pp. 45-52. University of Pisa, Italy.
- Hassi ML, Laursen S (2009). Studying undergraduate mathematics: exploring students' beliefs, experiences and gains. *Proceedings of the Thirty First Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education. VOL.5*, 113-121.
- Haveman R, Wolfe B (1995). The determinants of children's attainments: A review of methods and findings. *J. Econ. Literature*. 33:1829–1878.
- Hebb DO (1955). Drives and the conceptual nervous system. *Psychol. Rev.* 62:243-254.
- Jimerson S, Egeland B, Teo A (1999). A longitudinal study of achievement trajectories factors associated with change. *J. Educ. Psychol.* 91:116–126.
- Jordan D, LeMetals J (1997). Social skilling through cooperative learning. *Educ. Res.* 39:3-21.
- Klebanov PK, Brooks-Gunn J, Duncan GJ (1994). Does neighborhood and family poverty affect mothers' parenting, mental health, and social support? *J. Marriages Fam.* 56: 441-455.
- Kwon ON, Rasmussen C, Allen K (2005). Students' retention of knowledge and skills in differential equations. *Sch. Sci. Math.* 105(5):227-239.
- Lockheed M, Fuller B, Nyirongo R (1989). Family effects on students' achievement in Thailand and Malawi. *Sociology of Education* 62: 239-256.
- Luster T, Rhoades K, Haas B (1989). The relation between parental values and parenting behavior: A test of the Kohn Hypothesis. *J. Marriage Fam.* 51:139–147.
- Malmivuori ML (2001). The dynamics of affect, cognition, and social environment in the regulation of personal learning processes: The case of mathematics. Research Report 172, University of Helsinki.
- McLeod DB (1992). Research on affect in mathematics education: A reconceptualization. In D. G. Grouws (Ed.), *Handbook of research on mathematics teaching and learning*. New York: McMillan Library Reference. pp. 575–596
- Philipp RA (2007). Mathematics teachers' beliefs and affect. In F. K. Lester (Ed.), *Second handbook of research on mathematics teaching and learning: A project of the national council of teachers of mathematics* (pp. 157–224). Charlotte, NC: Information Age Publishing.
- Prince M, Felder R (2007). The many facets of inductive teaching and learning. *J. Coll. Sci. Teach.* 36(5):14-20.
- Richardson V (1996). The role of attitudes and beliefs in learning to teach. In J. Sikula (Ed.), *(Handbook of research on teacher education* (2nd ed., pp. 102–119). New York: Macmillan.
- Rotter JB (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs*, 80 (whole No. 609. 1).
- Schoenfeld AH (1987). What's all the fuss about metacognition? In A. H. Schoenfeld (Ed.), *Cognitive science and mathematics education* Hillsdale, NJ: Lawrence Erlbaum. pp. 189-215.
- Sewell W, Hauser R (1980). The Wisconsin longitudinal study of social and psychological factors in aspirations and achievements. *Res. Sociol. Educ. Socialization* 1: 59-99.
- Smith JC (2006). A sense making approach to proof: Strategies of students in traditional and problem-based number theory courses. *J. Math. Behav.* 25:73-90.
- Smith JR, Brooks-Gunn J, Klebanov PK (1997). Consequences of living in poverty for young children's cognitive and verbal ability and early school achievement. In G. J. Duncan & J. Brooks-Gunn (Eds.), *Consequences of growing up poor*. New York: Russell Sage Foundation. pp. 132-189.
- Stevenson HW, Newman RS (1986). Long-term prediction of achievement in mathematics and reading. *Child Dev.* 57:646-659.
- Teachman JD (1987). Family background, educational resources and educational attainment. *Am. Sociol. Rev.* 52: 548-557.
- Thompson AG (1984). The relationship of teachers' conceptions of mathematics and mathematics teaching to instructional practice. *Educ. Stud. Math.* 15:105-127.
- Thompson AG (1985). Teachers' conceptions of mathematics and the teaching of problem solving. In E. A. Silver (Ed.), *Teaching and learning mathematical problem solving: Multiple research perspectives* Hillsdale, NJ: Lawrence Erlbaum. pp. 281-294.
- Thompson AG (1992). Teachers' beliefs and conceptions: A synthesis of the research. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* New York: Macmillan. pp. 127–146.
- Tocci C, Engelhard G (1991). Achievement, parental support, and gender differences in attitudes toward mathematics. *J. Educ. Res.* 84 (5):28-34.
- Törner G (2002). Mathematical beliefs - a search for a common ground. In G. C. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* Dordrecht: Kluwer Academic Publishers. pp. 73–94
- Trusty J (2000). High educational expectations and low achievement: stability of educational goals across adolescence. *Journal of Educational Research* 93(6): 356-366.
- Weiner B (1985). An Attribution Theory of Achievement Motivation and Emotion, 64 *PSYCHOL. REV.* 557:557–73
- Wilkins JL.M, Ma X (2003). Modeling change in student attitude toward and beliefs about mathematics. *J. Educ. Res.* 97(1):52-63.

Appendix

1	Parents' Age	Father age
2	Parents' degree	Father degree
3	Parents' job	Father job
4	Parents' salary	Father salary per month
5	Parents' Age	Mother age
6	Parents' degree	Mother degree
7	Parents' job	Mother job
8	Parents' salary	Mother salary per month
9	Students' attention on mathematical lessons	How much attention do you pay to your math teachers in the classroom?
10	Students' attention on mathematical lessons	How much attention do you pay to your mathematics lesson?
11	Students' mathematical understanding compare to other lessons	How much difficulty do you have in understanding mathematics than physics' lessons?
12	Students' mathematical understanding compare to other lessons	How much difficulty do you have in understanding mathematics than English lessons?
13	Students' mathematical understanding compare to other lessons	How much difficulty do you have in understanding mathematics than Persian literatures' lesson?
14	Students' beliefs about teachers' role on their mathematical understanding	How much effect does teachers' teaching method have in your mathematical understanding?
15	Students' beliefs about teachers' role on their mathematical understanding	How much effect does math teachers' behavior have in your mathematical understanding?
16	Students' beliefs about the effects of their try on mathematical performance	How much effect does doing math exercise and homework have in your mathematical learning and understanding?
17	Students' beliefs about the effects of their try on mathematical performance	How much effect does students' perseverance has on learning mathematics?
18	Students' beliefs toward mathematics	How much incescent does your interest to mathematics have, when you solve a difficult math problem?
19	Students' beliefs toward mathematics	How much comprehensive is mathematics in your opinion?
20	Students' beliefs toward mathematics	How much applicable is mathematics in real life?
21	Students' beliefs toward mathematics	How much pleasant feeling do you have, when you remember your math teachers?
22	Students' beliefs toward mathematics	How much important is this statement? "Students should enjoy mathematics"
23	Students' beliefs toward mathematics	How much improvement do students have on problem solving in real life if they understand mathematics well?
24	Students' beliefs toward mathematics	How much mathematics can be useful for your life?
25	Parents' attitudes towards mathematics	How much your father interest in mathematics?
26	Parents' attitudes towards mathematics	How much your mother interest in mathematics?
27	Students' Attitudes toward mathematics	How much do you like to be a mathematics teacher?
28	Students' Attitudes toward mathematics	How much is your speed in learning mathematics more than other lessons?
29	Students' Attitudes toward mathematics	How much do you think that mathematics class's time should be increase?
30	Parents' satisfaction from students	How much do you help other persons in your family?
31	Parents' satisfaction from students	How much popularity do you have in your family?
32	Parents' satisfaction from students	How much satisfaction does your family has from you?

