

Effects of perceived difficulties of parents towards math and home expectations to the math achievement of students

Jarrent Tayag

College of Education, Angeles University Foundation, Angeles City, Philippines
Graduate School, Angeles University Foundation, Angeles City, Philippines

Marycris Lenon

Integrated School, Angeles University Foundation, Angeles City, Philippines

Joseph Bacanay

Integrated School, Angeles University Foundation, Angeles City, Philippines

Abstract: While several variables have been attributed to cause significant effects towards the math achievement of students, the mechanism by which these variables influence the paths is still under investigation. This study aimed to explore the effect of two variables – perceived difficulties of parents towards math and home expectations – to the math achievement of students using SEM-PLS. Convergent and discriminatory validity and reliability were established and the model fits the data from 115 intermediate students. Results show that the perceived difficulties of parents towards math significantly affect the math anxiety of students. Further, the math achievement of students is significantly affected by their math anxiety. The relationship between perceived difficulties of parents towards math and math achievement is possible through a full mediation model. Home expectations is significantly affecting math achievement. Perceived difficulty of parents, however, negatively moderates the pathway.

Keywords: Math Achievement; Perceived Difficulties of Parents towards Math; Math Anxiety; Home Expectations

Article History: Received: 22 Jan 2023, Accepted: 01 Mar 2024, Published: 20 Mar 2024

INTRODUCTION

The immediate environment of a learner has always been a crucial factor in the academic achievement of the students. The role of parents, for instance, in providing support for their children's education has been pointed out as an essential and potent force in the schools (Wilder, 2014). Teachers and school administrators would appeal to parents to be actively involved in the academic preparation of their children by attending parents-teachers conferences, supervising the completion of homework and projects, and providing emotional and psychological support to students. However, several limitations have also been identified that tend to limit parental involvement in the process. For instance, the study of Zhan (2006) revealed that parental assets have positive association with their involvement in the academic work of their children. This implies that parents who have economic resources tend to be more involved in the education of their children. In contrast, parents who may be experiencing economic difficulties may focus more in providing for their children rather than involving themselves with the academic activities of students.

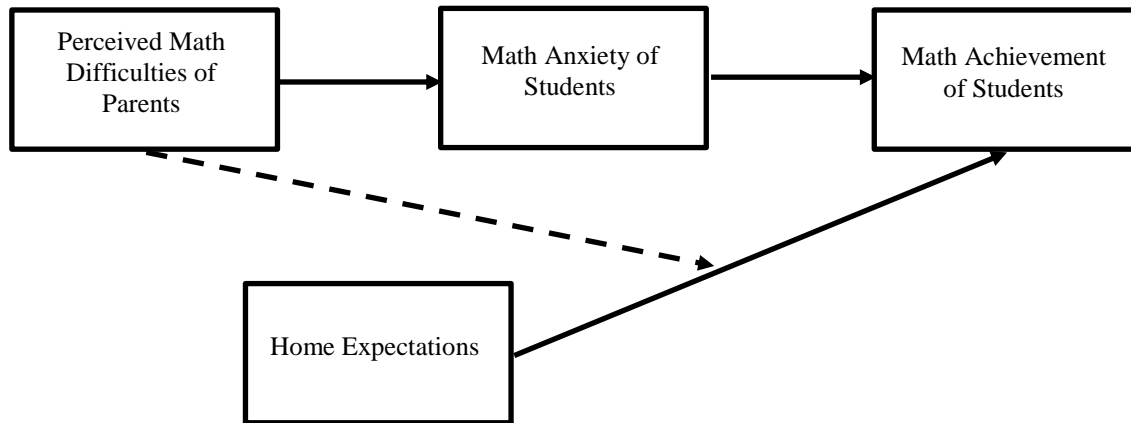
While parental involvement may have significant relationship with the general academic performance of students (Fan & Chen, 2001; Sheldon & Epstein, 2005; Driessen, Smit & Slegers, 2005), student-related factors, such as anxiety, have also been cited to have impact on the achievement of students. In particular, math anxiety is said to cause negative impact towards the math achievement of students (Zakaria & Nordin, 2008; Ma & Xu, 2004; Ashcraft & Krause, 2007). Math anxiety may have been loosely defined in different literature, but the most common perception relates to the negative feelings of students towards the subject, ultimately interfering with their capacity to comprehend and analyse mathematical equations and problems. Ramirez and others (2013) noted that math anxiety among young children may be associated with the high use of working memory. Children who engage into

EFFECTS OF PERCEIVED DIFFICULTIES OF PARENTS IN MATH AND HOME EXPECTATIONS TO THE MATH ACHIEVEMENT OF STUDENTS

problem solving activities tend to worry that they may not be able to acquire the answer, thus, increasing their level of anxiety and decreases their likelihood to obtain the correct answer.

The present study puts together parental involvement and math anxiety to understand further the interplay of these variables into the math achievement of children. In particular, this study investigates the effect of perceived math difficulties of parents to the level of math anxiety of their children, which is deemed to impact their math achievement. At the same time, this study examines the expectations of parents towards the math achievement of their children.

Figure 1. Proposed model showing association of variables through direct and indirect pathways



Perceived math difficulties of parents and math anxiety of children

Parents are part of the immediate ecology of the child. In the perspective of Bandura's social learning theory, parents could be considered as the first social circle from whom children would learn different concepts and skills in the early age. Prior and even during the first few years of schooling, parents are seen as influential people in the lives of the children. Because children still lack the ability to determine which particular concept and skills are to be learned, it is up to the parents to decide in which environment is the former to be exposed to acquire the concepts and skills. Park and Sarkar (2007) supported this by establishing the relationship between the attitudes of parents and their children's perception towards heritage language. Because parents have a positive attitude towards their heritage language, they set and communicate expectations to their children, which the latter eventually imbibe. In contrast, Gunderson and others (2012) reported that negative attitudes towards math can be attributed to the same negative attitudes of parents towards the subject. Both reports point out that parents can affectively influence the development of their children.

Math anxiety among children has always been identified as a negative factor in the academic achievement of students. However, less has been mentioned about the source of such anxiety. Maloney and others (2015) provided an empirical support on the possible role of parents in the development of math anxiety among students. In their study, they have found that parents who are anxious in math appear to pass on the anxiety to their children through their interaction whenever doing homework. This ultimately provides a foreground to intergenerational transmission of math anxiety from parents to children. These findings somehow contradict Jameson (2014) which reported that environmental factors, including parental anxiety, do not have significant influence over the math anxiety of second-graders. Instead, he pointed out that self-concept and self-efficacy of children are more potent predictors of math anxiety. The present study is leaning towards proving that parents who have experienced difficulties in math can influence the math anxiety of their children. Parents, being influential people in the early development of children, can effectively transfer values and shape attitudes of their children. The family culture, often influenced by the parents, also take an active part in the cultivation of attitudes such as academic anxiety. From these premises, the following hypothesis is proposed:

H1: There is a significant relationship between perceived math difficulties of parents and their children's math anxiety.

Math anxiety and math achievement

Ramirez and his associates (2013) and Ashcraft and Krause (2007) have proven that math anxiety can influence the math achievement of both young and adolescent students. Ramirez and others (2013), however, qualified that among young children, math anxiety can only intervene with academic performance of those with higher working memory. This means that when children engage to more challenging problem-solving approaches, their anxiety level increases and eventually affecting their

overall math performance. This is an affirmation of the works of Ashcraft and Moore (2009), in which they noted that the results in standardized math tests of anxious students underestimate their true abilities. Wu and others (2012) reported that math anxiety can detrimentally impact young children's math achievement regardless of the nature by which they have developed such negative attitude. In a more recent study conducted by Ramirez and others (2016), they discovered that children with high math anxiety try to avoid using complex problem-solving approaches, thereby reducing their math achievement. Much of the studies pertinent to academic achievement, including that in math, focus on central constructs such as motivation and efficacy. However, these constructs are possibly affected by negative attitudes such as anxiety. Thus, it is not a far shot to assume that math anxiety can impact the academic achievement of students. Thus, the following hypothesis is proposed:

H2: There is a significant relationship between the math anxiety of students and their math achievement.

Home expectations and math achievement

Home expectations refer to the aspirations of parents towards their children relevant to their academic activities. It is logical to think that these expectations can influence the quality of interactions that parents can have towards their children. In effect, the results of Davis-Kean (2005) showing that high parental expectations have positive association with the students' standardized scores. Froiland, Peterson, and Davison (2013) also noted that parental expectations can raise student expectations that can eventually increase academic achievement. While there may be a number of definitions for parental involvement in literature, Wilder (2014) observed that it can have the highest influence on student achievement when it is defined as parental expectations. These studies essentially establish the association between expectations and academic achievement of students. The present study also proposes a possible positive relationship between home expectations and math achievement of students.

H3: There is a significant relationship between the home expectations of parents to the children's math achievement.

Perceived math difficulties of parents on home expectations and math achievement

The fourth hypothesis included in the model concerns the possible moderating effect of perceived math difficulties to the relationship between home expectations and math achievement of students. From literature, it is stated that higher expectations of parents towards the academic performance of their children may lead to better achievement. However, it is also possible that such relationship may be affected by the personal experience of difficulty of parents towards math. Because parents have also experienced the same difficulty, they may be able to have lower expectations towards their children.

H4: Perceived math difficulties of parents moderates the relationship between home expectations and math achievement of children.

METHODOLOGY

Sample

The participants of the study are 115 intermediate school (4th to 6th grade) students and their parents. The participants come from a private school in the Philippines. The students were given informed consent forms to be accomplished by their parents. The number represents the students who returned a signed consent form (76% retrieval rate). The distribution of the respondents is shown in Table 1.

Table 1. Sample Distribution

Grade Level	f	%
Grade 4	34	29.56
Grade 5	56	48.70
Grade 6	25	21.74
Total	115	100

Instruments

Child Math Anxiety Questionnaire. The questionnaire was developed by Ramirez and others (2013). It has eight questions to be answered using a 5-point Likert scale, indicating the extent of nervousness that students feel. The questionnaire was particularly designed for young students, making it suitable for the respondents of the present study.

Parental Involvement Questionnaire. This questionnaire is derived from the work of Vukovic,

EFFECTS OF PERCEIVED DIFFICULTIES OF PARENTS IN MATH AND HOME EXPECTATIONS
TO THE MATH ACHIEVEMENT OF STUDENTS

Roberts, and Green Wright (2013). Originally, the questionnaire comprises of five sub-scales. For this study, only two of these sub-scales have been reported as they are the only ones that showed significant effects to the dependent variable. The two sub-sections are perceived difficulties of parents (3 items) and home expectations (4 items). Perceived difficulties of parents in math essentially inquires of the experiences of parents in math particularly dealing with the difficulties that they have encountered. Home expectations refers to the aspirations that parents have towards the academic achievement of their children in math. The questionnaire was answered by the parents of the students using a 5-point Likert scale indicating the extent of their agreement (or disagreement).

Math Achievement Test. The math achievement test scores are derived from the results of the year-end achievement test of the students. It is a standardized test administered by the Center for Educational Measurement, Inc. It is a 40-item test that measures the level of mastery of students across different mathematical strands covered during the academic year.

Data Collection and Analysis

The study utilized structural equation modelling through partial least squares (PLS) to determine the effects of perceived difficulties of parents and home expectations to the math achievement of the students. PLS is suited for the determination of simultaneous effects of variables towards another variable. Table 2 shows the reliability indicators for the variables. Both the Cronbach’s alpha and composite reliabilities passed the desired threshold of >0.60. This suggests that there is internal consistency among the data. Further, the square root of the average variance extracted (AVE) is greater than the correlations between the constructs. This establishes the discriminant validity of the data.

Table 2. Reliability of Constructs

	α	CR	1	2	3	4
Math Anxiety	0.787	0.789	(0.651)			
Perceived Difficulties	0.745	0.766	0.269	(0.726)		
Home Expectations	0.593	0.628	0.265	0.442	(0.613)	
Math Achievement	1	1	0.316	0.103	0.162	(1)

To determine the adequacy of sample for factor analysis, the Kaiser-Meyer-Olkin (KMO) Test was done. The KMO value is at 0.751 indicating that the sample is adequate. Table 3 shows the normalized factor loadings of each of the indicators for each of the constructs. All the constructs have factor loadings >0.70 and do not have significant cross-loadings to other constructs. This implies that the indicators attributed to each of the constructs are contributory to the intended constructs. The results from Table 3 also establishes the convergent validity of the tools used.

Table 3. Factor Loading of Constructs

	Anxiety	Perceived Difficulty	Home Expectations
AX1	0.864		
AX2	0.907		
AX3	0.912		
AX4	0.879		
AX5	0.920		
AX6	0.819		
PD1		0.917	
PD2		0.889	
PD3		0.803	
HSE1			0.882
HSE2			0.819
HSE3			0.791

FINDINGS

The model shows the significant paths between the variables. The model fits the data well: Average path coefficient (APC) = 0.301, $p < 0.001$; Average R-squared (ARS) = 0.165, $p < 0.017$; Average block VIF (AVIF) = 1.086, (ideally < 3.3); Average full collinearity (AFVIF) = 1.756 (ideally < 3.3); Tenenhaus goodness of fit (GoF) = 0.277 (medium > 0.25); Simpson’s paradox ratio (SPR) = 1.000, ideally = 1; R-squared contribution ratio (RSCR) = 1.000, ideally = 1; Statistical suppression ratio (SSR) = 0.750, acceptable is > 0.70 ; Non-linear bivariate causality direction ratio (NLBCDR) = 1.000, acceptable if > 0.70 .

Figure. 2. Mediation and Moderation Model
(PD – perceived difficulties of parents; HSE – home expectations)

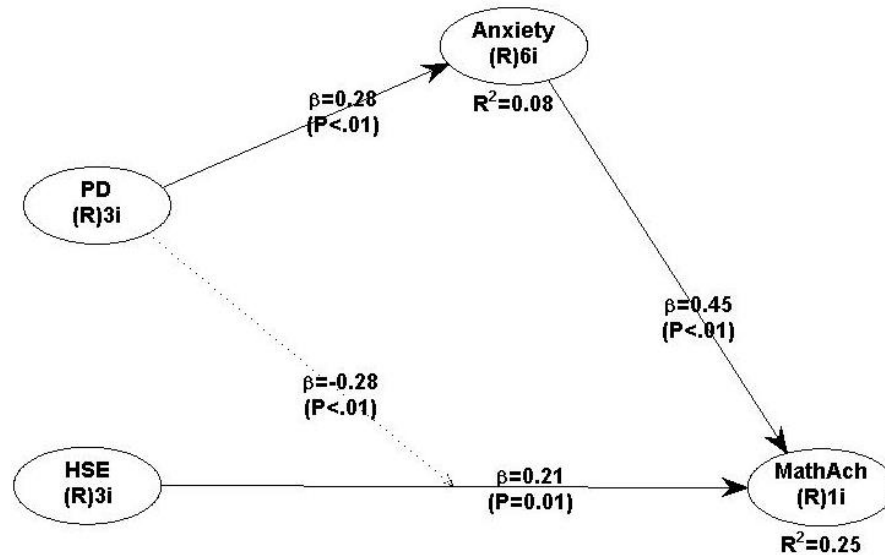


Figure 2 illustrates that the perceived difficulties of parents towards math (PD) can significantly affect their children’s anxiety in math ($\beta=0.28$, $p < 0.01$). This could be attributed to the potent influence of parents towards the formation of attitudes and values of their children towards their education. Ideally, the positive attitude towards learning can be transmitted by parents to their children by encouraging them to study their lessons or helping them with academic requirements. However, given that many parents may have negative attitudes towards math, the same may be transmitted to their children. This corroborates with the findings of Maloney and others (2015) in which they noted that difficulties of parents in math may be detract their student achievement in the subject.

Table 4. Tabulation of hypotheses decisions based on proposed model

Hypotheses	Decision	Direction (Beta value)
H1	Supported	Positive
H2	Supported	Positive
H3	Supported	Positive
H4	Supported	Negative

In the same path, children’s anxiety can also affect their math achievement. However, contrary to existing literature, math anxiety in this study reported a positive effect ($\beta=0.45$, $p < 0.01$). One plausible reason for this is that the anxiety felt by students towards the math may be helping them to be more critical whenever they are doing their academic work. Students tend to doubt whether they have been doing the right solution, thereby causing the anxiety. The established negative impact of anxiety towards math performance is often attributed to the stressful threshold that anxiety can impose upon an individual. However, the results of the study may be pointing to an alternative perspective in which anxiety can make a student more critical towards their academic work. Considering the nature of mathematics education, in which a number of drills on computation and problem-solving are introduced in various grade levels at increasing complexities. Errors committed by students in math exercises would always include minor mistakes in analyzing the elements of the problem or mere algorithmic errors. Even academically inclined

EFFECTS OF PERCEIVED DIFFICULTIES OF PARENTS IN MATH AND HOME EXPECTATIONS TO THE MATH ACHIEVEMENT OF STUDENTS

students commit errors as simple as incorrect use of operations or even improper decimal placement. All these errors could have been avoided if the students have just spent a few more moments looking back and re-examining their work before turning it in. A small amount of anxiety could have pulled back the student and make them think twice of their computations.

At plain sight, it may be easy to conclude that the perceived difficulties of parents towards math can negatively impact the performance of their children as they are likely to imbibe anxiety towards math. However, using the proposed model, it may be said that the difficulty of the parents may have brought about a certain level of anxiety among the students that allowed them to work harder to understand the concepts, thereby improving their performance in the subject. A parochial perspective of individual constructs may hide such effect and formulate segmented conclusions on the actual interactions between and among the variables. The indirect effect of perceived difficulties of parents towards math achievement of students is significant ($p=0.028$), whereas the direct effect is not significant (not shown in the figure) indicating that the former affects the latter through a full mediation model. This suggests that even if parents have the capacity to transfer negative attitudes like anxiety to their children, children are still able to use this to inspire them to do better. In the Asian societies, parents are usually supportive of the education of their children to the point that they do everything that is possible to prevent their children from experiencing difficulties that they encountered before. Some parents would hire private tutors, provide extra materials, and have regular consultation with their children's teachers to ensure that they are given the needed support.

Another salient finding from the model is the relationship between perceived home expectations and math achievement of students. It appears that home expectations (HE) is significantly affecting the math achievement of students ($\beta=0.21$, $p=0.01$). This conforms to many existing studies relating the expectations of parents and the academic achievement of students. When parents set high expectations for their children, students usually have better achievement. In Asian societies, families usually have expectations in the academic performance of their children. In most cases, this leads to academic anxiety. In a way, this contributes greatly to the culture wherein students really exert time and effort to complete their education and bring pride to their family. In the context of the results of the study, the cited anxiety of students, cascading from their parents, may somehow lead to higher achievement. This, does not, however, disproves previous literature on the negative effects of anxiety not only in the academic lives of students but even to their social aspects. What is offered by the results of the model is that the possibility that at a certain extent, anxiety may be necessary to empower students to fulfil their academic loads.

An interesting finding of the study is the moderating effect of perceived difficulties of parents towards the path between home expectations and math achievement ($\beta=-0.28$, $p<0.01$). This suggests that as parents experience difficulty in math, their expectations towards the performance of their students in math may decrease. While they have high expectations for their children, the relationship between these expectations and the achievement of their children may be lowered by the parent's own perceived difficulty in the subject. This may imply that parents can be in a better position to understand their children whenever they are encountering difficulties in understanding mathematical concepts.

The study essentially explores the complex networks of variables involved between parental involvement and math achievement of students. Previous studies have already confirmed that parents can significantly affect the academic performance of their children. However, the mechanism by which this relationship happens is still being investigated. The present study implicates the personal difficulties that parents may have towards math to their expectations towards the performance of their children. Probably because parents share the same experience of having difficulty in their math subjects, they cannot provide the same support to their students in accomplishing tasks and homework. As an effect, parents tend to lower their expectations towards the performance of their children.

On the other hand, it has also been established in the model that while such lower expectations may exist, the perceived difficulties of parents may increase the anxiety of students towards the subject. Despite the prevalence in literature of the negative influence of anxiety to academic performance, the model proposes that it may help, to some extent, in keeping the students on their toes while solving math problems and equations. A common issue of teachers when students are answering mathematical problems is that they are careless and would not think twice before providing an answer. In this study, it is seen that a certain level of anxiety can actually lead to better performance. On matters of mediation, perceived difficulties of parents may increase the anxiety of students, which eventually influences their math performance. This suggests that parental difficulties in the subject can only influence their performance through a mediator, in this case, anxiety.

CONCLUSIONS

The study investigated the effects of perceived difficulties of parents towards math and home expectations to the math achievement of their children. The findings of the study include: (a) perceived

difficulty of parents significantly affects the math anxiety of students; (b) math anxiety significantly affects the math achievement of students; (c) home expectations significantly affects the math achievement of students; (d) the relationship between perceived difficulty of parents and student math achievement is mediated by math anxiety; (e) perceived difficulty of parents is a negative moderator between home expectation and math achievement. One of the limitations of the study is the relatively small sample size, thereby limiting the findings to the specific contexts of the respondents. Future research may consider larger sample size to confirm the findings.

REFERENCES

- Ashcraft, M. H., & Krause, J. A. (2007). Working memory, math performance, and math anxiety. *Psychonomic bulletin & review*, 14(2), 243-248.
- Ashcraft, M. H., & Moore, A. M. (2009). Mathematics anxiety and the affective drop in performance. *Journal of Psychoeducational Assessment*, 27(3), 197-205.
- Davis-Kean, P. E. (2005). The influence of parent education and family income on child achievement: the indirect role of parental expectations and the home environment. *Journal of family psychology*, 19(2), 294.
- Froiland, J. M., Peterson, A., & Davison, M. L. (2013). The long-term effects of early parent involvement and parent expectation in the USA. *School Psychology International*, 34(1), 33-50.
- Gunderson, E. A., Ramirez, G., Levine, S. C., & Beilock, S. L. (2012). The role of parents and teachers in the development of gender-related math attitudes. *Sex roles*, 66(3-4), 153-166.
- Jameson, M. M. (2014). Contextual factors related to math anxiety in second-grade children. *The Journal of Experimental Education*, 82(4), 518-536.
- Maloney, E. A., Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2015). Intergenerational effects of parents' math anxiety on children's math achievement and anxiety. *Psychological Science*, 26(9), 1480-1488.
- Park, S. M., & Sarkar, M. (2007). Parents' attitudes toward heritage language maintenance for their children and their efforts to help their children maintain the heritage language: A case study of Korean-Canadian immigrants. *Language, culture and curriculum*, 20(3), 223-235.
- Ramirez, G., Chang, H., Maloney, E. A., Levine, S. C., & Beilock, S. L. (2016). On the relationship between math anxiety and math achievement in early elementary school: The role of problem-solving strategies. *Journal of experimental child psychology*, 141, 83-100.
- Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2013). Math anxiety, working memory, and math achievement in early elementary school. *Journal of Cognition and Development*, 14(2), 187-202.
- Vukovic, R. K., Roberts, S. O., & Green Wright, L. (2013). From parental involvement to children's mathematical performance: The role of mathematics anxiety. *Early Education & Development*, 24(4), 446-467.
- Wilder, S. (2014). Effects of parental involvement on academic achievement: A meta-synthesis. *Educational Review*, 66(3), 377-397.
- Wilder, S. (2014). Effects of parental involvement on academic achievement: A meta-synthesis. *Educational Review*, 66(3), 377-397.
- Wu, S., Amin, H., Barth, M., Malcarne, V., & Menon, V. (2012). Math anxiety in second and third graders and its relation to mathematics achievement. *Frontiers in psychology*, 3, 162.
- Zhan, M. (2006). Assets, parental expectations and involvement, and children's educational performance. *Children and Youth Services Review*, 28(8), 961-975.