```stata
 1    capture log close
 2
 3    * Project name:  TIMSS 2011 Taiwan 4th Grade Final Project
 4    * STATA version: 12
 5    * Date: April 26, 2015
 6    * Author: Xuan Pu, Yinying Li, Yujia Ji
 7    * Email:xp2136@tc.columbia.edu, yl3184@tc.columbia.edu, yj2331@tc.columbia.edu
 8
 9    clear
10    set more off
11
12    * I'm changing the working directory
13    cd "E:\Spring 2015\Homework\Quantitative Study\Final Paper\data file"
14
15    * I'm calling the dataset from the working directory
16    use "Taiwan_4Gr_2011.dta", clear
17
18    * I'm saving the dataset under a new name to prevent any problems later on. By doing so I
      create a copy of the original file.
19    save "Taiwan_4Gr_2011", replace
20
21    * I'm starting a log file in which all of my work will be saved
22    log using "ITSF 4104 Yujia Ji final project.smcl", replace
23
24    * I keep the useful variables
25    keep IDSCHOOL ITSEX ASDAGE ASBG04 ASBG05A ASBG05B ASBG05C ASBG05D ASBG05E ASBG07A ASBG07B
      ASBG07C ASBG07D ASBGESL ASBGSCS ASBGSLS ASSSCI01
26
27    clonevar school_ID=IDSCHOOL
28    clonevar female=ITSEX
29    clonevar student_age=ASDAGE
30    clonevar books_at_home=ASBG04
31    clonevar pos_computer=ASBG05A
32    clonevar pos_desk=ASBG05B
33    clonevar pos_books= ASBG05C
34    clonevar pos_ownroom=ASBG05D
35    clonevar pos_internet=ASBG05E
36    clonevar par_ask_learning=ASBG07A
37    clonevar par_talk_school=ASBG07B
38    clonevar par_make_sure=ASBG07C
39    clonevar par_check=ASBG07D
40    clonevar engage_science=ASBGESL
41    clonevar confidence_science=ASBGSCS
42    clonevar liking_science=ASBGSLS
43    clonevar score_science=ASSSCI01
44
45    codebook IDSCHOOL ITSEX ASDAGE ASBG04 ASBG05A ASBG05B ASBG05C ASBG05D ASBG05E
46    codebook ASBG07A ASBG07B ASBG07C ASBG07D ASBGESL ASBGSCS ASBGSLS ASSSCI01
47
48    recode books_at_home (9=.)
49    recode pos_computer(9=.)
50    recode pos_desk(9=.)
51    recode pos_books(9=.)
52    recode pos_ownroom(9=.)
53    recode pos_internet (9=.)
54    recode par_ask_learning(9=.)
55    recode par_talk_school(9=.)
56    recode par_make_sure(9=.)
57    recode par_check (9=.)
58    recode engage_science(999999=.)
59    recode confidence_science(999999=.)
60    recode liking_science(999999=.)
61
62    *I use the listwise deletion approach to drop students with missing information
63    mark miss
64    tab miss, m
65    markout miss books_at_home pos_computer pos_desk pos_books pos_internet pos_ownroom
      par_ask_learning par_talk_school par_make_sure par_check engage_science confidence_science
       liking_science
66    tab miss, m
67    drop if miss == 0
68    tab miss, m
69
70    *I creat new variables for different types of parental involvement
```

```stata
 71    recode par_ask_learning (1=8)(3=1)(8=3)(4=0)
 72    recode par_ask_learning (8=3)
 73    tab2 par_ask_learning ASBG07A
 74    tab par_ask_learning, nol
 75    label define asklearning 0"0_never" 1"1_once a month" 2"2_once a week" 3"3_everyday"
 76    label values par_ask_learning asklearning
 77    tab par_ask_learning
 78
 79    recode par_talk_school (1=8)(3=1)(8=3)(4=0)
 80    recode par_talk_school (8=3)
 81    tab2 par_talk_school ASBG07B
 82    tab par_talk_school, nol
 83    label define talkschool 0"0_never" 1"1_once a month" 2"2_once a week" 3"3_everyday"
 84    label values par_talk_school talkschool
 85    tab par_talk_school
 86
 87    *I use the command "egen" to create the new scale
 88    egen parent_child_discussion = rowmean(par_ask_learning par_talk_school)
 89    tab parent_child_discussion
 90
 91    recode par_make_sure (1=8)(3=1)(8=3)(4=0)
 92    recode par_make_sure (8=3)
 93    tab2 par_make_sure ASBG07C
 94    tab par_make_sure, nol
 95    label define makesure 0"0_never" 1"1_once a month" 2"2_once a week" 3"3_everyday"
 96    label values par_make_sure makesure
 97    tab par_make_sure
 98
 99    recode par_check ASBG07D (1=8)(3=1)(8=3)(4=0)
100    recode par_check (8=3)
101    tab2 par_check ASBG07D
102    tab par_check, nol
103    label define check 0"0_never" 1"1_once a month" 2"2_once a week" 3"3_everyday"
104    label values par_check check
105    tab par_check
106
107    *I use the command "egen" to create the new scale
108    egen checking_homework = rowmean(par_make_sure par_check)
109    tab checking_homework
110
111    recode pos_computer(2=0)
112    recode pos_desk(2=0)
113    recode pos_books(2=0)
114    recode pos_ownroom(2=0)
115    recode pos_internet(2=0)
116
117    *I use the command "egen" to create the new scale
118    egen possessiontotal = rowtotal(pos_computer pos_desk pos_books pos_ownroom pos_internet)
119
120    *I add variable label and value labels to the new scale
121    label define possession 0 "0_no home possession" 1 "1_1possession" 2 "2_2possession" 3
       "3_3possession" 4 "4_4possession" 5 "5_5possession", replace
122    label values possessiontotal possession
123
124    *I check the change
125    tab possessiontotal
126
127    tab books_at_home,nol
128
129    recode books_at_home (1=0)(2=1)(3=2)(4=3)(5=4)
130
131    *I add variable label and value labels to the new scale
132    label define books_home 0 "0_none or few 0 to 10" 1 "1_one shelf 11 to 25" 2 "2_one
       bookcase 26 to 100" 3 "3_two bookcases 101 to 200" 4 "4_three or more bookcases more than
       200"
133    label values books_at_home books_home
134
135    tab books_at_home
136
137    **Multiple Regression:
138    *DV: score_science IV: BOOKS(Categorical)
139
140    *Step 1: BOOKS(Categorical): books
141    reg score_science books_at_home
```

```stata
142        **Interpret Coefficients
143        *To get standardized coefficients
144        listcoef, help
145
146    *Step 2: Turn Categorical Variables into individual Dummy variables
147        tab books_at_home, gen (Books)
148        rename Books1 books0_10
149        rename Books2 books11_25
150        rename Books3 books26_100
151        rename Books4 books101_200
152        rename Books5 books200more
153
154    *Step 3: Reference Category (Dependent on your Research Question) --> 0-10Books
155    reg score_science books11_25 books26_100 books101_200 books200more
156
157    recode female(2=0)
158
159    sum score_science female student_age books_at_home possessiontotal engage_science
       confidence_science liking_science parent_child_discussion checking_homework, detail
160    sum books11_25 books26_100 books101_200 books200more, detail
161
162    * I will use Ordinary Least Squares (OLS) regression analysis
163    reg score_science books11_25 books26_100 books101_200 books200more
164    reg score_science parent_child_discussion
165    reg score_science checking_homework
166    reg score_science possessiontotal
167    reg score_science books11_25 books26_100 books101_200 books200more parent_child_discussion
        checking_homework possessiontotal
168    reg score_science books11_25 books26_100 books101_200 books200more parent_child_discussion
        checking_homework female student_age confidence_science liking_science engage_science
       possessiontotal
169
170    listcoef, help
171
172    reg score_science books_at_home
173    reg score_science parent_child_discussion
174    reg score_science checking_homework
175    reg score_science possessiontotal
176    reg score_science books_at_home parent_child_discussion checking_homework possessiontotal
177    reg score_science books_at_home parent_child_discussion checking_homework female
       student_age confidence_science liking_science engage_science possessiontotal
178
179    reg score_science female student_age books_at_home books11_25 books26_100 books101_200
       books200more possessiontotal engage_science confidence_science liking_science
       parent_child_discussion checking_homework,cluster(school_ID)
180
181    *This is the end of my work (for now), so I save the data file
182    save "TIMSS2011 Taiwan 4th Grade Final Project", replace
183
184    *I close the log
185    log close
186
187
188
189
```

The Influence of Parental Involvement on

4th Grade Students' Science Achievement in Taiwan

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ITSF4101.003: Quantitative Analysis in CIE

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Introduction

As a way believed to help improve pupil's academic performance, parental involvement

has been a subject of a great deal of research for a long time. Attempts to improve parental

involvement in education have occupied governments, administrators, educators and

organizations worldwide. In East Asia, where respect for education and scholarship is deeply

rooted in tradition, parents play a strong role in their children's education, holding high

expectations for academic achievement and generally getting more involved in kids'

educational life.

Since Asian parents make such great contributions to their children's academic career,

what is the real influence of parental involvement on these students, and what type of parental

involvement is mostly influential? In order to arrive at a better understanding of the question,

we choose Taiwan as the target research area as a representative for the phenomenon. To be

more specific, in the research we use TIMSS 2011 data to look for the impact of parental

involvement on 4th grade students' science achievement. Major reasons for choosing this

research topic are as follows:

1. Trends in International Mathematics and Science Study (TIMSS) provides reliable and

    timely data.

2. School differences are not the primary concern of the study. In the primary school level

    the impact caused by differences associated with variations in the quality of schools is

    smaller than higher educational level.

3. Compared with mathematics study, which is closely associated with students' own (innate)

    mathematical thinking ability, science subject at the primary level is more comprehensive

and easy to probe into.

Our investigation is based on the general assumption that parental involvement is positively correlated with students' science achievement. In the test we control variables that may interfere as student gender, school difference and children's own characteristics. The dependent variable is science score while the independent variable is parental involvement, which is treated as a multidimensional construct with four dimensions: secure and stable environment, intellectual stimulation, parent-child discussion and participation in the work of the school. We assumed and expected to find that in all these types of parental involvement, "participation in the work of the school" may have the most influential power on Taiwan students' academic performance.

According to the analysis above, our research question can be stated as: The influence of parental involvement on 4th grade students' science achievement in Taiwan.

Literature Review

There are plenty of researches on the influence of parental involvement over education. Desforges and Abouchaar (2003) in their book summarized different parental involvement forms, including secure and stable environment, intellectual stimulation, parent-child discussion and participation in the work of the school, which provides theoretical basis for the variable selection in this study: we choose "home possessions" for secure and stable environment, "books at home" for intellectual stimulation, "ask about learning and school" for parent-child discussion and "check whether doing homework" and "check if finished" for participation in the work of the school.

Studies that support the significant positive influence of parental involvement on

educational outcomes are abundant. Barnard (2004) examined such influence and concluded

that parent involvement in school was an important component in early childhood education

to help promote long-term effects. As for research particularly focused on the situation in

Taiwan, Liu (2008) argued that there was a positive correlation existing between parents'

participation and academic achievements of primary students. Also, the depth of parents'

participation was highly correlated with the accuracy of the predictions made about children's

future academic achievements. Chen (2011) probed into the question from the perspective of

parents' participation in children's early reading experience at primary school level. She

found that parental involvement in reading could help promote students' abilities overall.

Influences of parental involvement have been further analyzed in other studies. Research

results offered by McNeal (1999) indicated that parental involvement was generally a salient

factor in explaining behavioral but not cognitive outcomes. Besides, the findings of Fan and

Chen's groundbreaking research (2001) revealed a small to moderate relationship between

parental involvement and academic achievements. They argued that parental aspiration for

children's education achievement showed the strongest relationship, whereas home

supervision had the weakest one, providing insights into the problem from a new angle.

Based on the literature review and research models of the study, we put forward our own

hypothesis:

Null hypothesis

H_{01}: There is no statistically significant association between home possessions and 4th grade

students' achievement in science in Taiwan.

H_{02}: There is no statistically significant association between books at home and 4th grade

students' achievement in science in Taiwan.

H_{03}: There is no statistically significant association between parent-child discussion and 4th

grade students' achievement in science in Taiwan.

H_{04}: There is no statistically significant association between parents' participation in the work

of the school and 4th grade students' achievement in science in Taiwan.

Alternative hypothesis

H_{A1}: There is statistically significant association between home possessions and 4th grade

students' achievement in science in Taiwan.

H_{A2}: There is statistically significant association between books at home and 4th grade

students' achievement in science in Taiwan.

H_{A3}: There is statistically significant association between parent-child discussion and 4th

grade students' achievement in science in Taiwan.

H_{A4}: There is statistically significant association between parents' participation in the work of

the school and 4th grade students' achievement in science in Taiwan.

Data and Methods

The database we use is from TIMSS 2011 Taiwan 4th grade, which consists of 4,284 4th

grade students from 150 schools in Taiwan. We use list wise deletion to clean all the

observations that has missing data among the variables we choose and have a total number of

4,055 observations in our study.

Since our major research question is focus on the influence of parental involvement on

4th grade students' achievement in science, our dependent variable is science score of 4th

grade. In terms of parental education, based on literature review, we use four items as our

independent variables, which are "home possessions in total", "books at home", "parental

children discussion about school", and "parents checking homework". Within those variables

we choose, "home possession in total"[1] contains 5 basic items and 5 country specific items,

which in Taiwan are "security system", "at least two bedrooms with bathrooms", " two

private cars", "pianos or violins", and "servants". However, because relevant questions only

exist in TIMSS student questionnaire, all the information collected are student report and

therefore may be not entirely accurate. In addition, because there are many other factors that

may also lay effects on students' achievement in science, we will control them in the study.

Due to the limitation of the items TIMSS questionnaire covered, we select our controlling

variables as following: gender (female), confidence in science, liking science, and

engagement in science.

As for the method, we chose Ordinary Least Squares (OLS) regression analysis as the

statistical tool to answer our research question and analyze the influence of parental

involvement on students' science score, controlling for gender (female), confidence in science,

liking science, engagement in science. Also, we used the standardized version of

multi-regression so as to compare the influence of variables with different units on students'

science scores.

According to Table 1, there are slightly more males than females among 4th grade

students who attended the TIMSS 2011 Taiwan (mean=.48).

Based on students' self-reported results, most of their parents discuss about learning and

school with them once or twice a week (mean=1.87), but there is a huge variation among the

---

[1] G5 in questionnaire: "Do you have any of these things at your home?"

frequencies that students report (SD=.98). Also, the majority of the students report that their

parents check homework once or twice a week, but it's a little bit more frequent than their

parents discussing about school with them (mean=2.22).

For liking science, engagement in science and confidence in science, we all use scale

instead of index variables. The scale of liking science is based on seven items in

questionnaire for students; the scale of engagement in science is derived from five items; and

the scale of confidence in science is rooted in six items in the questionnaire. According to

Table 1, most of students like science (mean=10.2, SD=1.99, ranging from 3.79 to 12.17).

Average of engagement in science is relatively high (mean=9.74, SD=2.08, with a large range

from 2.74 to 13.03). And most of students feel confident about learning science (mean=10.11,

SD is 1.99, ranging from 3.33 to 13.45).

The average science score for Taiwan 4th Grade students that participated in TIMSS 2011

is 557.56, with standard deviation of 71.2 points. As for home possessions, we combine five

variables together, excluding country-specific variables which focuses on the rich class of

Taiwan's society, so the range is from 0 to 5, and most of students have most of the basic

possessions, with a comparatively small variance between students (mean= 4.2, SD= .95).

Regarding the amount of books at home, the average amount of books that 4th grade

Taiwan students possess at home are 11-25 books, but it's pretty diversified (mean=1.95, SD

=1.26, range from 0 to 4). And most of students have 25-100 books at home since it has the

highest mean (mean=.32); students having 11-25 books at home come second (mean= .22);

number of students who have 0-10 books, 101-200 books and more than 200 books are very

close (mean=.15, .16 and .15 respectively).

Table 2 includes 6 models of regression analysis with a sample size of 4,055. The first

four models use the four different types of parental involvement being its independent

variable respectively. By comparing the R^2 of the first four models in Table 2, we intend to

find which aspect of parental involvement can explain the highest variance in students'

science achievement, without controlling for other variables. In addition, we also conduct a

standardized regression model in Table 3 to compare the β of the four aspects of parental

involvement accounting for other variables. By doing it, we can triangulate with the findings

in Table 2 to conclude which aspect of parental involvement is most influential on Taiwan 4th

graders science score. And the fifth model puts all the four aspects of parental involvement

together so as to find out the overall influence of parental involvement on students science

score. The sixth model is built upon the fifth one, by both including the four aspects of

parental involvement and taking variables of students' characteristics that might influence

their science score into consideration, namely gender (female), the level of students' liking

science, confidence in science and engagement in science. In other words, conducting the

sixth model reveals the influence that parental involvement exerts on Taiwan 4th graders'

science score after controlling for other important variables.

In the first four models, the coefficients of the four aspects of parental involvement

(home possessions, books at home, discussion about school, and checking homework) are

9.30, 18.40, 10.16, and 10.55 respectively. Therefore, the correlations between every aspect

of parental involvement and students' science score are all positive and statistically

significant (p<.001). It means that with one unit of increase of home possessions, there will

be 9.30 points of increase in students' achievement in science, with one unit of increase of

books at home, students' science score will be 18.4 points higher, with one unit increase of

discussion about school, there will be 10.16 points of improvement in science score, and with

one unit increase of checking homework, students will achieve 10.55 points higher in science.

More importantly, this pattern is applicable to the whole Taiwan 4th grade students. If

considering the four aspects of parental involvement separately, without controlling for other

variables, R^2 of home possessions, books at home, parents discussing about school and

checking homework are .02, .11, .02 and .02 respectively, meaning that 2% of the total

variance of students' science achievement can be explained by their home possessions; 11%

of the total variance can be explained by the amount of books at home; discussion about

school can explain 2% of the variance of science score; 2% of the variance of science

achievement is associated with parents checking homework. And according to Table 3, books

at home has the highest β (β=.28, which means with every increase of one SD of books at

home, science score will increase .28 SD. p<.001), compared to all the other independent

variables. Therefore, we are confident to conclude that books at home is the most influential

aspect of parental involvement that affects Taiwan 4th grade students' science score.

Model 5 contains all four different types of parental involvement, which shows the total

influence of parental involvement on science score. The table shows that after combining the

four aspects together, only books at home (intellectual stimulation) and checking homework

(participation in the work of the school) are significant (p<.001) and have relatively large

coefficients (16.93 and 4.67), whereas the coefficient of the rest two decrease greatly and

become insignificant. It means that there is a lot of overlapping area among these four aspects

of parental involvement. But the R^2 of Model 4 is .11, meaning that 11% of the variance of

science achievement is associated with all four kinds of parental involvement as a whole,

which can still be considered as a large share that explains the total variance of science score.

Based on Model 5, Model 6 further controls variables of student characteristics that may

influence science score, namely gender (female), the level of students' liking science,

confidence in science and engagement in science. After controlling all the other variables, the

coefficient of the four aspects of parental involvement, home possession in total, books at

home, discussion about school and checking home work all decrease. Again, only books at

home and checking homework remains significant (p<.001) and have relatively large

coefficients (15.82 and 4.25). After Model 6, we also conduct a cluster command in STATA

to consider the similarity between students in terms of attending the same school, which

shows the similar results as Model 6.

Since books at home (intellectual stimulation) is the most influential aspect of parental

involvement, we are interested in how the amount of books at home influence students'

science score. Thus, we employ another two models in Table 4 to delve into the pattern.

Model 1 uses students with 0-10 books at home as the reference group, so each coefficient is

the difference of science scores between students with 0-10 books and the respective group.

As shown in the Model 1 of Table 4, compared with students with 0-10 books at home,

students with 11-25 books at home achieve 36.97 points higher, students with 26-100 books

at home score 59.64 points higher, students with 101-200 books at home have 75.05 points

more, and students with more than 100 books at home achieve 74.03 points higher on average.

Therefore, it's clear to see that with the increase of books at home from 0 to 200, there is a

relatively large increase in students' science scores, but students who have more than 200

books at home score pretty much the same as students with 101-200 books at home. In other words, there are several jumps of science scores with the increase of books at home, but when the amount of books is larger than 100, the increase of science scores become flat and minimal (as shown in Figure 1), which brings us to the question of inequality between students with no or very few resources at home and students with more resources at home.

Conclusions

Based on the regression results, it is clear that the four aspects of parental involvement we choose all have significant positive influence on students' science score. Therefore, we reject H_{01} that there is no statistically significant association between home possessions and 4th grade students' achievement in science in Taiwan, and accept H_{A1} that there is a statistically significant association between home possessions and 4th grade students' achievement in science in Taiwan.

We reject H_{02} that there is no statistically significant association between books at home and 4th grade students' achievement in science in Taiwan, and accept H_{A2} that there is a statistically significant association between books at home and 4th grade students' achievement in science in Taiwan.

We reject H_{03} that there is no statistically significant association between parent-child discussion and 4th grade students' achievement in science in Taiwan, and accept H_{A3} that there is a statistically significant association between parent-child discussion and 4th grade students' achievement in science in Taiwan.

We reject H_{04} that there is no statistically significant association between parents' participation in the work of the school and 4th grade students' achievement in science in

Taiwan, and accept H_{A4} that there is a statistically significant association between parents' participation in the work of the school and 4th grade students' achievement in science in Taiwan.

According to the R^2 of parental involvement as a whole (see Appendix Table 2 Model 5), we further conclude that parental involvement is correlated with 11% of the variance in 4th grade Taiwanese students' science achievement. This finding corresponds with previous literature studying on this topic and shows that parental involvement plays an important role in terms of students' academic performance. However, the R^2 of the four sub-dimensions shows that our assumption about parents asking school and checking homework would be the most influential one is wrong.

Furthermore, as a set of complicated interventions, parental involvement is consisted of different forms and activities. Each of the four aspects we choose has a different level of positive correlation with science score. Among them, books at home has the highest coefficient (18.40) and the highest R^2 (.11), making it the variable that has the largest influence on students' science achievement in our analysis. Another interesting fact about this variable is also revealed by the data (see Appendix table 3 and figure 1). It is shown that the effects of books at home on science score is not linear. The influence first climbs as the amount of books increase from 10 to 100. However, after the amount reaches 100 and more, the influence goes to flat. Since books at home is highly relevant to factors such as family background or parental education level, this finding implies how family social-economic states (SES) may play a role to enlarge the inequality of students' achievement in science and thus worth the attention from society. In the meantime, because the increase in science

achievement is not linear with the increase of possession of books, it also implies that

increasing family investment in it does not necessarily lead to corresponding level of increase

in terms of children' s school work.

As mentioned above, parental involvement is a set of different interventions. However,

due to the limit of TIMSS data base, we only include variables related to secure and stable

environment, intellectual stimulation, parent-child discussion and participation in the work of

the school, which are four aspects of parental involvement. It is suggested that further study

can incorporate more activities of parental involvement and conduct more comprehensive

analysis. Also, since our model explains 17% of the variance in 4th grade students' science

achievement, there is much more factors to be explored. For example, it is possible that

school difference and region difference account for a large portion of the achievement

variance, which is usually the case especially in less developed areas. All of those

possibilities worth further discussions.

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Appendix

Table 1: Definitions and Descriptive Statistics of Variables (n=4,055)

Variable	Definition and metrics	Mean	SD	Min	Max
Science score	First plausible value (PV1) of science result	557.56	71.20	295.43	766.1
Female	Male =0, Female = 1	.48	-	0	1
Parents discussing about learning and school	Average of two items: how often do your parents ask about leaning; how often do your parents talk about school at home Scale: 0= Never 1= Once or twice a month 2= Once or twice a week 3= Everyday Reliability (alpha) = .62	1.87	.98	0	3
Parents checking homework	Average of two items: how often do your parents make sure you are doing homework; how often do your parents check your homework Scale: 0= Never 1= Once or twice a month 2= Once or twice a week 3= Everyday Reliability (alpha) = .60	2.22	.99	0	3
Confidence in science	Level of students' confidence with science	10.11	1.99	3.33	13.45

Liking science	Level of students' liking learning science	10.20	1.99	3.79	12.17	
Engagement in science	Scale of engagement with science lesson based on 5 items	9.74	2.08	2.74	13.03	
Home possession	Sum of five items: Whether students possess a computer, books(do not count school books), desk, room, Internet connection, at home or not Scale: 0= No possession 1= One possession 2= Two possessions 3= Three possessions 4= Four possessions 5= Five possessions Reliability (alpha) = .43	4.20	.95	0	5	
Books at home (reference group: 0-10 books at home)	Amount of books at student's home 0= 0-10 BOOKS 1=11-25 BOOKS 2=26-100 BOOKS 3=101-200 BOOKS 4 =MORE THAN 200	1.95	1.26	0	4	
Amount of books at home 0 to 10 books	The dummy variable of students having 0 to 10 books at home 0 = No 1 = Yes	.15	-	0	1	Frequency 609
Amount of books at home 11 to 25 books	The dummy variable of students having 11-25 books at home 0 = No 1 = Yes	.22	-	0	1	Frequency 882
Amount of books at home 25 to 100 books	The dummy variable of students having 11-25 books at home 0 = No	.32	-	0	1	Frequency 1291

	1 = Yes					
Amount of books at home 101 to 200 books	The dummy variable of students having 101 to 200 books at home 0 = No 1 = Yes	.16	-	0	1	Frequency 649
Amount of books at home more than 200 books	The dummy variable of students having more than 200 books at home 0 = No 1 = Yes	.15	-	0	1	Frequency 624

Source: [TIMSS, 2011]

Table 2 Varying relations between parental involvement and science achievement (n=4,055)

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Parental involvement						
Home possession in total	9.30*** (1.16)				1.68 (1.17)	.55 (1.14)
Books at home		18.40*** (.84)			16.93*** (.90)	15.82*** (.88)
Discussion about school			10.16*** (1.13)		1.48 (1.32)	1.58 (1.31)
Checking homework				10.55*** (1.12)	4.67*** (1.30)	4.25*** (1.27)
Student characteristics (controlling variables)						
Female						-7.74*** (2.10)
Liking science						1.54* (.72)
Confidence in science						6.04*** (.68)
Engagement in science						-.96 (.63)
R square	.02	.11	.02	.02	.11	.15

Source: [TIMSS 2011]

Note: Numbers in parentheses are robust standard errors. See text for description of measures

*$p<.05$ (two-tailed test)

**$p<.01$(two-tailed test)

***$p<.001$(two-tailed test)

Table 3 Standardized Multi-Regression (n=4,055)

	Books at home	Discussion about school	Checking homework	Female	Confidence in science	Liking science	Engagement in science	Possession in total
bStdXY	.28***	.02	.06***	-.05***	.17***	.04*	-.03	.01

Source: [TIMSS 2011]

Note: bStdXY= xy-standardized coefficient

*p<.05 (two-tailed test)

**p<.01(two-tailed test)

***p<.001(two-tailed test)

Table 4 Varying relations between parental involvement and science achievement (n=4,055)

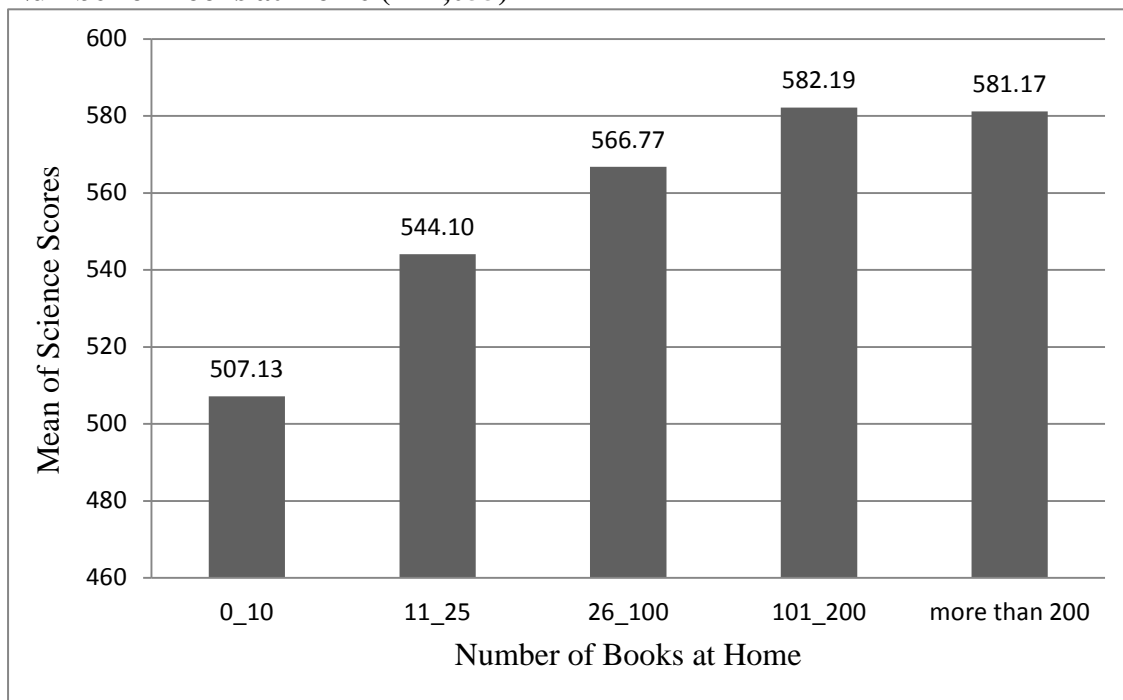| Variable	Model 1	Model 2
Home possession in total		-.26
		(1.14)
Books 11-25	36.97***	33.48***
	(3.51)	(3.49)
Books 26-100	59.64***	54.80***
	(3.28)	(3.35)
Books 101-200	75.05***	67.90***
	(3.76)	(3.87)
Books more than 200	74.03***	64.51***
	(3.80)	(3.96)
Discussion about school		1.27
		(1.29)
Checking homework		3.85**
		(1.26)
Female		-8.48***
		(2.08)
Liking science		1.39*
		(.71)
Confidence in science		6.23***
		(.68)
Engagement in science		-1.05
		(.62)
R square	.12	.17

Source: [TIMSS 2011]

Note: Numbers in parentheses are robust standard errors. See text for description of measures.

*p<.05 (two-tailed test)

**p<.01(two-tailed test)

***p<.001(two-tailed test)

Chart 1: Bar Graph for the Pattern of the Mean of Science Scores in Terms of the Number of Books at Home (n=4,055)

Source: [TIMSS, 2011]