Doctoral Dissertation

Empirical Studies of Child Well-being and Education

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Abstract

This dissertation consists of three chapters that explore factors that influence children's education. The first chapter investigates how schools influence parents in order to get them more involved in their children's education. Samples of elementary and middle school children were analysed separately using a weighted multilevel model and results show that associations are different according to the school level. For the sample of elementary school children, informing about school is positively associated with home-based parental involvement. On the other hand, informing about children's learning progress is positively associated with it for eighth grade.

The second chapter investigates the effects of parental involvement on academic achievement. It also examines how students' attitude towards subjects and educational aspiration mediate the relationships between parental involvement and achievement. Samples were analysed by school level, by gender, and by subject (mathematics and science). The analyses were conducted by using a weighted generalised multilevel structural equation model. Results showed that students' attitude and aspiration mediate associations between parental involvement and academic achievement at both elementary and middle school. Also, associations between parental involvement and academic achievement vary according to school level, gender, and subjects. Notable differences are that, in elementary school, monitoring types of involvements are associated with achievements both directly and indirectly. On the other hand, in middle school, those types of involvements influence achievement indirectly rather than directly.

The third chapter investigates the independent effects of maternal and paternal involvement on adolescents' achievement. Also, it examines how adolescents' educational aspiration mediates the relationships between parental involvement and grades. Samples of middle school students were analysed separately according to adolescents' gender. The analyses were conducted by using a generalised structural equation modelling. Results show that both maternal

and paternal involvement influences adolescent's academic outcome independently. Adolescent's educational aspirations mediate the association between parental involvement and academic grade. Also, discussion topics that are related to adolescents' schooling is more significantly associated with grades.

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Introduction

Education is essential for children. UNESCO (2017) states that education "promotes individual freedom and empowerment and yields important development benefits." Studies show that education is related to better health (Oreopoulos, 2007; Haveman, 1994), happiness (Oreopoulos, 2007), and higher voter participation and civic knowledge (Dee, 2004). It reduces teen pregnancy rate (Black, et al., 2008) and criminal activities (Lochner and Moretti, 2004). Moreover, Hanushek and Woessmann (2012) show that educational achievement, or cognitive skills, is associated with economic growth.

Two major international tests exist in order to measure and improve education: International Mathematics and Science Study (TIMSS), which is conducted by International Association for the Evaluation of Educational Achievement (IEA) since 1995 and Programme for International Student Assessment (PISA) which was launched in 1997 by OECD. Since then, more than 60 countries participated in TIMSS and more than 70 countries for PISA. It indicates that many countries are concerned about ways to improve their citizen's education.

This dissertation explores a sequence of influence on children's education with focusing on parental involvement (see Figure I): school influences parents which, in turn, influence children. Parents are essential in children's daily lives and they play a significant role in their children's education. For example, Hoover-Dempsey and Sandler (1995) states that parental involvement influences educational outcome through three mechanisms: modelling of school related behaviours and attitudes, reinforcing specific aspects of school learning, and instruction. Researchers actively encourage parents to get involved in their children's education to increase academic performance (e.g., Hoover-Dempsey and Sandler, 1995; Hoover-Dempsey et al., 2005; Blazer, 2009). On the other hand, studies also show that not only parents, but also school-family partnerships are essential for children's education (Epstein, 1992; Epstein and Sanders, 2000; Eccles and Harold, 1996: Shimizu, 2012). Therefore, how parents influence

children's education and how schools prompt parents to get involved with it are important concerns for educators and policymakers.

Parental involvement includes a range of practices by the parent toward their children that are intended to promote the latter's motivation and educational achievement. Most commonly, it is categorized in home-based and school-based involvement (e.g., Hoover-Dempsey and Sandler, 1997; Galindo and Sheldon, 2012; Deslandes and Bertrad, 2005). School-based involvement includes practices taking place at school; for example, attending school events, conference, and volunteering. Home-based involvement is related to practices taking place outside of school such as learning activities at home, reviewing the child's work, monitoring their progress, helping them with homework, and discussions about school events (Hoover-Dempsey and Sandler, 1997; Pomerantz et al., 2007). The dissertation adopts the home-based versus school-based categorization. However, since school-based involvement is subject to external factors that cannot be controlled by this study (e.g., nonflexible work schedule of parents), it is not used as a measure of parental involvement. Since home-based involvement is less likely to be affected by such problems, it should be a better indicator of the actual outcomes.

This dissertation explores the following questions: (1) how does school outreach influence parental involvement? (2) how does parental involvement influence children's education? It breaks down the sample in order to understand differences between school levels (e.g., elementary and middle school) and gender. Most previous studies do not take these factors into account and this study addresses this gap in order to understand the true mechanisms of parental involvement. The first chapter investigates how informative school outreach influence parental involvement at different school levels. The second and the third chapter investigate how parental involvement influence children's education. The second chapter focuses on different school levels and the third chapter focuses on gender. This dissertation contributes towards a better understanding of parental involvement: it empirically shows how it is prompted by school and in turn, how it influences children' education. It gives significant insight for policymakers

and educators to develop policies for improving children's education.

The analyses are conducted with Japanese data. Despite Japanese education being recognized as one of the world's best, there is a striking shortage of empirical works on Japan due, in part, to the limited availability of micro data on students and their family. Therefore, in order to fill in this gap, this study uses Japanese data. Overviews of each chapter are summarized below.

Chapter 1 – Effects of Informative School Outreach on Parental Involvement of Elementary and Middle School Children

The first chapter investigates how informative school outreach (informing the parents about their children and the school) influence home-based parental involvement (communicating and monitoring) in different school levels (elementary and middle school). A number of studies have shown that parental involvement is an essential part of children's education, and it can bring positive impact on their school achievement (e.g., Sui-Chu and Willms, 1996), attitude (e.g., Fantuzzo et al., 2004) and behaviour (e.g., Hill et al., 2004).

However, not all parents are involved to the same degree. Studies have been conducted to understand its mechanism. Even though a number of studies address the importance of school-family partnerships (e.g., Epstein, 1992; Eccles and Harold, 1996), the number of empirical studies is still limited and they show inconsistent results. Some studies find positive effects (e.g., Dauber and Epstein, 1989), but others find negative or insignificant effects (e.g., Simon, 2004; Feuerstein, 2000). These discrepant results likely reflect the varying definitions of school outreach and parental involvement. Also, parental involvement changes according to the school level of the child (Eccles and Harold, 1996). Hence, effective school outreach would also be different depending on the school level. However, previous studies failed to examine the effects of school outreach on parental involvement at different stages of children's development.

This study uses the Japanese sub-sample from TIMSS 2011 to investigate how school outreach influences parental involvement at different school levels. A two-stage random sample

design was employed to collect the sample. Schools were drawn as a first stage and, one class of students were selected from each of the sampled schools as a second stage. Due to the sampling procedure used in TIMSS 2011, weighted multilevel model analyses were conducted.

Results show that the associations are different according to the levels of school of the children. Informing about school is positively associated with home-based parental involvement for elementary school students. On the other hand, informing about children's learning progress has a positive association for middle school students. The differences in results may reflect the parents' different concerns at their children's different school levels. Parents of elementary school children tend to be more concerned about their children's relationships with other friends and behaviours of everyday life, while parents of middle school children tend to care more about their academic achievement (Benesse Educational Research and Development Institute, 2011). Schools could play an important role in encouraging parents of younger children to place more importance on education by informing them about school matters, such as rules and educational goals. As for the parents of children in middle school, in addition to their concern about achievement, they are also thought to be concerned about their children's preparation for competitive high school examinations. Hence, at this stage of education, the child's learning progress is important and informing parents about it would prompt them to get involved more. The results of the study suggest that schools and educators can increase the frequency of parental involvement through implementing the practices according to the school level.

Chapter 2 – Effects of Parental Involvement on Academic Achievement among Elementary and Middle School Students

The second chapter investigates how parental involvement (communicating and monitoring) influences academic achievement by comparing the effects of parental involvement across three criteria: elementary and middle school (school level), male and female (gender), and math and science (subject). Also, the mediating effects of students' attitudes towards the subjects and

education between parental involvement and achievement are examined.

Researchers suggest that parental involvement is important for children's education (Hoover-Dempsey and Sandler, 1995; Hoover-Dempsey et al., 2005; Blazer, 2009). However, they do not agree on the effects of the relationship. While there are studies that conclude that parental involvement has positive impacts on school achievement (e.g., Wang and Sheikh-Khalil, 2014), other studies show insignificant or negative effects (e.g., Domina, 2005; Shumow and Miller, 2001; Shumow et al., 2011; Galindo and Sheldon 2012), or mixed results (e.g., McNeal, 1999). The discrepant results are attributed to several factors such as assigning different definitions of parental involvement, not controlling for important variables such as school levels (e.g., elementary and middle school) and gender, failing to capture indirect effects of parental involvement, and combining different subjects together (e.g., Math and Reading).

The unique contribution of this study is that it addresses the gaps pointed out in the previous paragraph by examining students in elementary and middle school separately utilising the same measurement of home-based parental involvement. Also, the study takes into account the indirect effects of parental involvement and examines whether students' educational attitude and aspiration mediate the associations between home-based parental involvement and mathematics and science achievements. The study uses a nationally representative sample of the Japanese sub-sample from TIMSS 2011. The analyses were conducted by using a weighted generalised multilevel structural equation model.

The findings reveal that the associations between parental involvement and academic achievement vary according to the school level, gender, and subjects. Both male and female students benefit from parental involvement regardless of the school level. On the other hand, the association between parental involvement and achievement is different between elementary and middle school. The notable difference is that, in the former, monitoring types of involvement (parents making sure children set aside time for their homework and checking homework) influence academic achievements both directly and indirectly (through enhancing attitudes

towards subjects). In the latter, they influence achievement indirectly. Also, effects of monitoring on achievement and attitudes are more significant among elementary than middle school students, which suggests that elementary students reap more benefits more from it. The results of the study suggest the importance of taking into account school level, indirect effects of parental involvement, types of involvement, and students' gender to understand how parental involvement influences academic achievement.

Chapter 3 – Effects of Maternal and Paternal Involvement on Adolescents' Academic Achievement and Aspiration

The third chapter investigates how maternal and paternal involvement (parental discussion and aspiration) influence female and male adolescent's achievement. Students' achievement is a major concern in many societies. A number of studies show that parental involvement increases students' achievement (e.g., Hoover-Dempsey et al., 2005; Blazer, 2009; Galindo and Sheldon, 2012). However, little is known about individual contribution that mothers and fathers make to their children's education since most studies do not distinguish between maternal and paternal involvement. In addition to this, literature is still largely focused on mothers (Kim and Hill, 2015) even though researchers suggest that fathers also contribute in important ways (Lewis and Lamb, 2003; Lamb, 1975; Sarkadi et al., 2008). Therefore, it is important to examine the effects of mothers and fathers independently in order to better understand the mechanism behind the relationship between parental involvement and academic achievement.

Also, in several studies mothers are found to be more supportive and comforting compared to fathers who are more likely to encourage children to take risks, challenges and exploration (e.g., Paquette, 2004; Grossmann et al., 2002; Rogers et al., 2009). Even though these differences may be the result of socially constructed standards of behaviours (see West and Zimmerman, 1987; Connell, 1987), these findings suggest that fathers and mothers may influence their children differently. Besides, when their involvement is different, investigating both maternal and

paternal involvement simultaneously may help to understand what involvement is more effective for their children's education.

This chapter contributes to the literature by examining independent effects of maternal and paternal involvement, discussion and aspiration, on male and female adolescents' grade. Also, the study takes into account the indirect effects of parental involvement and examines whether students' educational aspiration mediate the associations between parental involvement and adolescents' achievement. A nationally representative sample of the Japanese middle school students was analysed separately according to their gender by using a generalised structural equation modelling.

Findings reveal that both maternal and paternal involvement influence adolescents' grade independently. Also, adolescent's educational aspirations mediate the association between parental involvement and academic grade. In addition to this, some different effects between mothers and fathers are found. Discussion topics that are related to adolescents' schooling is more significantly and positively associated with achievement.

Given the findings that both mothers and fathers independently influence adolescents' grades and aspiration, schools and policymakers may need to develop policies to encourage both maternal and paternal involvement. For example, schools can provide seminars for parents to encourage discussion with their children about their study and to learn how to discuss plans for high school entrance exams.

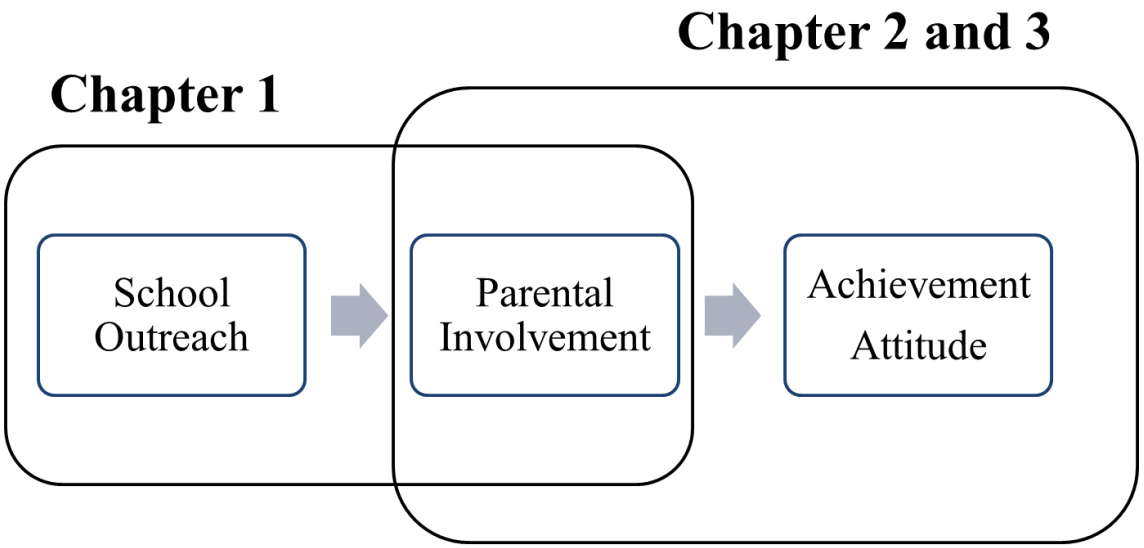


Figure I Structure of the Dissertation

Chapter 1: Effects of Informative School Outreach on Parental Involvement of Elementary and Middle School Children

1.1 Introduction

Parents play an important role in their children's education. For example, parental involvement in children's education has positive impacts on school achievement (e.g., Sui-Chu and Willms, 1996; Englund et al., 2004; Galindo and Sheldon, 2012), attitude (e.g., Fantuzzo et al., 2004; Shumow et al, 2011), and behaviour (e.g., Hill et al., 2004). As a result, many reports and studies encourage parental involvement to increase academic performance (e.g., Hoover-Dempsey et al., 2005; Blazer, 2009; Galindo and Sheldon, 2012).

However, not all parents are involved to the same degree in their children's education. Studies have been conducted to understand its mechanism. Even though researchers claim that socioeconomic status (SES) does not explain parents' decision of involvement and that they are not the most important measures to understand it either (Hoover-Dempsey and Sandler, 1995; Epstein, 1990), a common approach has been to examine the relationship between parental involvement and socioeconomic variables. Then, what would prompt parents to get involved in their children's education?

It is expected that schools have an influence on not only children but also their parents. From ecological perspectives, Bronfenbrenner (1977, 1979) stresses that environmental factors and their interactions have an influence on human development and behaviour. From this point

of view, schools can be one of the factors that influence parents since they interact with them throughout their children's school years. A number of studies do address the importance of school-family partnerships (Epstein, 1992; Epstein and Sanders, 2000; Eccles and Harold, 1996: Shimizu, 2012; Ochanomizu University, 2015). Nevertheless, few studies have tried to analyse its effects on parental involvement, and, seemingly no studies have compared the effects of school outreach among different school levels (e.g., elementary and middle schools).

Since enhancing children's academic achievement is an important concern for parents, teachers, and policymakers, it is also essential to understand the factors that increase parental involvement in a way that yields the highest possible results. Even though prior studies largely show a positive association between SES and parental involvement, it is difficult to change SES instantly. On the other hand, school outreach can be easily changed or defined by teachers and policies. Hence, it is important to understand how and what informative school outreach significantly influences parental involvement to enhance academic achievement.

The present study examines the effects of informative school outreach on parental involvement using a Japanese sample containing both middle and elementary school students extracted from the Trends International Mathematics and Science Study (TIMSS) 2011. It contributes to the literature by empirically confirming that effective informative school outreach varies across different school levels in the same way that children's needs and parents' concerns varies across the different developmental stages. Previous studies not only failed to estimate multiple school levels in the same model; but also used different definitions and measures across studies rendering appropriate comparisons unfeasible. By having a more precise grasp of the effects of different types of informative school outreach against grades in different school levels, policymakers and schools can design better strategies to encourage better academic performance.

This study controls not only for students, but also for school characteristics, which was not

considered in several previous studies, and uses both multidimensional and separate measures of home-based parental involvement as dependent variables to examine the robust effects of informative school outreach.

1.2 Definition

1.2.1 Parental Involvement

Parental involvement includes a range of practices by the parent toward their children that are intended to promote the latter's motivation and educational achievement. However, since parental involvement is multidimensional it has made it difficult to define it (Hill and Taylor, 2004), several different researchers make different categorizations. For example, Epstein (2001) suggests six categories of involvement: parenting, communicating, volunteering, learning at home, decision making, and collaborating within the community. Grolnick and Sowiaczek (1994) describe three categories of involvement: behaviour, cognitive-intellectual, and personal.

Most commonly, parental involvement is categorized in home-based and school-based involvement (e.g., Hoover-Dempsey and Sandler, 1997; Galindo and Sheldon, 2012; Deslandes and Bertrad, 2005; Green and Walker, 2007; Pomerantz et al., 2007; Anderson and Minke, 2007; Dauber and Epstein, 1989; Shumow and Miller, 2001). School-based involvement includes practices taking place at school; for example, attending school events, conference, and volunteering. Home-based involvement is related to practices taking place outside of school such as learning activities at home, reviewing the child's work, monitoring their progress, helping them with homework, and discussions about school events (Hoover-Dempsey and Sandler, 1997; Pomerantz et al., 2007).

The present study adopts the home-based versus school-based categorization. However, since school-based involvement can be more affected by external reasons which cannot be

controlled by this study (e.g., nonflexible work schedule of parents), it is not used as a measure of parental involvement. Since home-based involvement is less likely to be affected by such problems and should be a better indicator of the actual outcomes. In this study, home-based involvement includes communication with children about schoolwork (communicating) and monitoring their homework (monitoring).

Communicating and monitoring are commonly used as measures of parental involvement (e.g., McNeal, 2014; Sui-Chi and Willms, 1996). These measures reflect the level of social capital within the family, which in turn promotes the child's intellectual development (Coleman, 1987, 1988, 1991; Coleman and Hoffer, 1987). Parent-child communication regarding education conveys the importance of schooling to the child (McNeal, 1999, 2014). Monitoring is the regulation of activities that children engage in (e.g., watching TV or playing video games) and the supervision of homework. It protects children from harmful influences and helps to construct habits that are associated with desirable behaviour and educational performance (McNeal, 1999). Empirical studies show that these parental involvements prevent problematic behaviour and positively influence on achievement (e.g., Sui-Chi and Willms, 1996; Pong, 1997; McNeal, 1999, 2014)

The present study examines parental involvement both as multidimensional and separate measures. It is because even though parental involvement is a multidimensional construct, the inclusion of too many measures could mislead its intention. Therefore, to understand robust effects of school outreach, multidirectional analyses are conducted.

1.2.2 School Outreach

There is no concrete definition of school outreach. As a measure of school outreach, prior studies include various practices: informing parents about children's grades and behaviour, informing them about school activities, asking parents about volunteering, arranging meetings

and conferences, and providing workshop sessions. This study examines school outreach that informs parents about their children as students and the school.

1.3 Literature Review

1.3.1 Hoover-Dempsey and Sandler's Model

Hoover-Dempsey and Sandler (1995, 1997) presented a theoretical model of parental involvement process to understand why parents choose to become involved. According to the Hoover-Dempsey and Sandler's Model (the HDS model), parents' decision to become involved in their children's education is based on three factors: (1) parental role construction: parents' beliefs about what they are supposed to do in relation to their children's education, (2) parents' self-efficacy for helping children succeed in school, (3) parents' perception of invitations/demands and opportunities for involvement. Hoover-Dempsey and Sandler (1997) contend that parental role construction is the most important factor, and when it is significant, positive involvement decision would be likely to occur. Parental role construction is described in part by general role theory: expectations held by groups for the behaviour of individual member are the major generator of roles, and it is learned through experiences (Hoover-Dempsey and Sandler, 1997; Biddle, 1986). It indicates that parental role construction is shaped by the interactions between schools and parents and by the expectation that schools hold about parents' responsibilities toward their child's schooling (Hoover-Dempsey and Sandler, 1997).

Tests of the model have been conducted, and its utility among parents of elementary school children (Green et al., 2007; Anderson and Minke, 2007), middle school students (Deslandes and Bertrand, 2005), and high school adolescents (Park and Holloway, 2013) was confirmed. Additionally, Green et al. (2007) analysed parents of children in elementary through middle school and revealed that the model predicted parental involvement even when controlling for

SES. The theory was also tested in the Japanese context. Yamamoto et al. (2006) examined mothers of children in preschool and showed that their self-efficacy and role construction were associated with strategies for selecting preschools and frequency of engaging in home reading.

The predictions of this study are based on the HDS model. Given parental role construction is shaped by the interactions between schools and parents, informing parents about school and children would prompt parental role construction through enhancing their sense of responsibility for their child's education and, in turn, it would increase parental involvement (see Figure1.1).

1.3.2 School Outreach

Relatively few studies examined effects of school outreach on parental involvement and they have mostly shown positive influences of it. Dauber and Epstein (1989) found that elementary and middle school outreach influenced parental involvement positively. Stacer and Perrucci (2013) investigated parents of children from kindergarten to the fifth grade, and the results revealed that school outreach efforts increased home-based involvement. Sheldon et al. (2011) analysed from elementary to high schools and found a positive association between the effectiveness of math-focused school outreach and school level of parental involvement. Park and Holloway (2013) found that informative high school outreach (e.g., sending information about children, how to help homework, and college planning) is strongly associated with both school- and home- based parental involvement.

Some of the prior studies, however, did find negative or no association at all. Simon (2004) found most informative high school outreach, including information about academic programs, volunteering, how to help out with homework, positively predicted school- and home-based parental involvement. Meanwhile, high frequency of school contact to parents about their children's attendance and behaviour is negatively associated with most types of the parental

involvement. Galindo and Sheldon (2012) did not find any association between school outreach (kindergarten) and home-based involvement. Likewise, Feuerstein (2000) did not find associations between most of the school outreach and parental involvement among eighth grade.

These discrepant results are likely reflecting the various definitions of school outreach and parental involvement. For example, studies using a single index that includes various types of practices from providing workshops to informing about volunteering to measure school outreach (e.g., Galindo and Sheldon, 2012; Stacer and Perrucci, 2013) could lead to less precise results and fail to examine effects of different types of outreach. Additionally, studies that utilised combined data of school levels (kindergarten, elementary, middle, and high school) (Dauber and Epstein, 1989; Stacer and Perrucci, 2013; Sheldon et al., 2011) failed to examine the effects of school outreach on parental involvement at different stages of children's development. Since only a few studies investigated the relationship between school outreach and parental involvement, more research is needed to understand the relationships between these two factors.

1.3.3 Socioeconomic Status

Prior studies largely show a positive association between parental involvement and SES; namely, parent's level of education and family income (e.g., Kohl and McMahon, 2000; Waanders et al., 2007; Simon, 2004). Contradicting results, however, do exist (Galindo and Sheldon, 2012; Stacer, and Perrucci, 2013; Bhargava and Witherspoon, 2015; Anderson and Minke, 2007; Shumow et al., 2011; Yamamoto et al., 2006). For example, when focusing on home-based parental involvement, Galindo and Sheldon (2012) found a positive sign for parent's education but a non-significant value for income against home-based involvement. Also, some studies did not find any significant association between parents' SES and

home-based involvement (Shumow et al., 2011; Holloway et al., 2008).

Other studies show associations between SES and family-school relationship and parenting style (e.g., Lareau, 1987; Yamamoto, 2015; Honda, 2008; Matsuoka, 2015). Lareau (1987) examined parents in working-class and middle-class communities and found that, in both communities, parents valued educational success but the ways in which they promoted it differed. Parents in working-class communities believe that teachers are responsible for education, while, parents in middle-class communities have more interdependent relationships with schools and teachers, and they attended school events more often (Lareau, 1987). Yamamoto (2015) also found the similar result that working-class mothers are less likely to know how to intervene effectively to improve their children's academic performance and tend to rely on teachers for their child's academic direction. In addition to this, higher SES parents are more likely to have strict parenting style compared to lower SES parents (Yamamoto, 2015; Honda, 2008; Matsuoka, 2015). For instance, Yamamoto (2015) found that middle-class mothers tend to create routines to develop learning habits such as setting aside time for their children to complete homework compared to working-class mothers.

Even though the precise direction of the association is still unclear, it is important to take into account the effects of SES on parental involvement. Therefore, family SES is used as control variables to examine the true effects of informative school outreach.

1.3.4 Environmental Factors

From ecological perspectives, Bronfenbrenner (1977, 1979) stresses the importance of taking into account environmental factors and their interactions to understand human development and behaviour. Therefore, addition to individual-level factors like parents' SES, environmental factors such as neighbourhood and school characteristics (e.g., class size and school SES) can influence parental involvement. Previous studies show the influence of these

factors on parental involvement (Waanders et al., 2007: Smith et al., 1997; Bhargava and Witherspoon, 2015; Datar and Mason, 2008; Bonesrønning, 2004) and parental role construction (Whitaker and Hoover-Dempsey, 2015). For example, Datar and Mason (2008) analysed panel data from the kindergarten and first-grade waves and found that increases in class size are associated with a decrease in home-based parental involvement.

Many studies that examine parental involvement fail to control school characteristics variables, however, since they have the influence on parental involvement, it is necessary to control these factors.

1.4 Pursues of the Present Study

The aim of the study is to examine the effects of informative school outreach on home-based parental involvement for elementary and middle schools separately. As described above, previous studies mainly show positive relations between school outreach and parental involvement. However, these analyses fail to examine precise effects because they use pooled data including different school levels altogether (e.g., Stacer and Perrucci, 2013; Dauber and Epstein, 1989; Sheldon et al., 2011).

It is important to take into consideration children's school levels since it may affect parents' decision and types of involvement. For example, studies show that parental involvement tends to decrease for upper levels because of the level of difficulty of schoolwork and a more complicated structure of middle school system (e.g., students have several teachers) (Eccles and Harold, 1996; Hill and Tyson, 2009).

Also, elementary school children and middle school children have fairly different needs and parents seem to respond to them in different ways. According to a survey, while parents of elementary school children tend to care more about their behaviour and relationships; parents of middle school children are more concerned about educational achievement (Benesse

Educational Research and Development Institute, 2011). These beliefs can affect the parents' decision of involvement.

In this way, the effects of school outreach on parental involvement are also expected to vary according to the school level. However, as far as the author is concerned, no studies have compared the effects of school outreach between different school levels.

The present study intends to address this gap by investigating the following research questions: how does informative school outreach influence parents of children in different school levels (elementary and middle school) to get involved in their education at home? What types of informative school outreach are more effective in elementary and middle school, respectively? It is hypothesised that school outreach will present positive effects. It would prompt parental role construction, which in turn affects parental involvement positively (see Figure 1.1). As it was mentioned previously, parental role construction happens when schools transmit the expectations that they hold toward how parents should participate in children's education. It is expected that school outreach would convey these expectations and encourage parental role construction. Also, since parents of middle school children are more concerned about educational achievement (Benesse Educational Research and Development Institute, 2011), it is hypothesised that informative school outreach about their children's learning progress is more significantly associated with parental involvement in middle school than it is in elementary school. In addition to this, different patterns of association between informative school outreach and parental involvement according to school level are expected to emerge.

1.5 Method

1.5.1 Data

This study uses the Japanese sub-sample from Trends International Mathematics and Science Study (TIMSS) 2011. The survey was conducted by the International Association for

the Evaluation of Educational Achievement (IEA). TIMSS is an international assessment of student achievement in mathematics and science in the fourth and eighth grades. It also collects a wide range of information from students, teachers and school principals. This study uses the student and the school questionnaires. A two-stage random sample design was employed to collect the sample. Schools were drawn as a first stage and, in Japan, one class of students were selected from each of the sampled schools as a second stage. After deleting missing data, this study involves 3,939 fourth grade students from 140 schools and 4,132 eighth grade students from 133 schools.

1.5.2 Variables

Dependent Variables (Home-Based Parental Involvement)

As measures of home-based parental involvement, four questions from the student questionnaires that asked students to rate their perception of their parents' home-based involvement are used. The questions were asked and labelled as follow: "How often do your parents ask you what you learned in school?" (*Ask*); "How often do you talk about your schoolwork with your parents?" (*Talk*); "How often do your parents make sure that you set aside time for your homework?" (*Time*); and "How often do your parents check if you do your homework?" (*Check*). Answer categories were coded as follows: 1 = Never or almost never, 2 = once or twice a month, 3 = once or twice a week, 4 = every day or almost every day.

Based on this, three component variables and a binary variable were also created. The simple correlations between four measures are positive in the range from 0.28 to 0.54 for fourth and 0.34 to 0.70 for eighth grade. Among the four questions, *Ask* and *Talk* are strongly correlated (0.54 for fourth and 0.62 for eighth grade), as well as *Time* and *Check* (0.45 for fourth and 0.70 for eighth grade). Therefore, two composite measures were created by principal component analysis: *Communicating* (*Ask* and *Talk*) and *Monitoring* (*Time* and

Check). Factor analysis was also performed (promax rotation) with *Ask*, *Talk*, *Time*, and *Check* for each grade. Factors with an eigenvalue greater than 1 were retained, and it yielded a one-factor solution for both fourth and eighth grade and labelled as *Pi4*. Finally, one binary variable was created and labelled as *Pi0* that measures if parents engage in at least one type of the home-based practices. The variables are coded as follows: 1 = more than once a month, 0 = Never or almost never.

Informative school outreach measures include six questions from the School questionnaires. School principals were asked the questions regarding frequency of informative outreach. All of the questions began with "How often does your school inform parents about …?" The questions were: "their child's learning progress?"; "the behaviour and well-being of their children at school?"; "the overall academic achievement of the school?"; "school accomplishments?"; "the educational goals and pedagogic principles of the school?"; and "the rules of the school?". Answer categories were coded as follows: 1 = never, 2 = once a year, 3 = two to three times a year, 4 = more than three times a year. Factor analyses were performed (promax rotation) separately for elementary and middle school (see Table 1.1). Factors with an eigenvalue greater than 1 were retained and it yielded a two-factor solution. Two composites were created for fourth grade: *informing about students* and *informing about school*. However, as for eighth grade, the result indicated a Heywood case. Hence, a factor analysis was conducted again with the same questions that included informing about school for fourth grade. It yielded a one-factor solution and composed as *informing about school*. The two questions that were relevant to informing about students were used independently for eighth grade.

Control Variables

Several student and school level variables were included in the models to control statistically for important background factors.

Student Level Control Variable

Students' gender is dummy coded, 1 = female 0 = male. The measure of SES used in this study includes a number of books and materials related to educational well-being at home and the highest level of education completed by parents. The questions were answered by students. The number of books at home was coded as follows: 1 = 0-10 books, 2 = 11-25 books, 3 = 26-100 books, 4 = 101-200 books, 5 = more than 200 books. Index of possessions at home was created through adding eleven questions that ask if students have a specific item that is relevant to educational well-being (e.g., a computer and a desk for him/her own etc.). Since the distribution of addition of the eleven questions is not normal but truncated, a dummy variable was created to capture the effect of external value and labelled as *Possession at home 11*. The highest level of education completed by the mother and father was asked but only to eighth grade students. Binary variables were created for each educational level for both mothers and fathers. More than 30% of students in the sample did not know one of their parents' highest level of education. Since it is too large to drop from the data, a dummy variable was created as *unknown* instead of dropping them from the data. It enables to control effects of parents' educational level while keeping the students that do not know it in the sample. Also, eighth grade students were asked how often their teacher gives them homework. Based on that, frequency of mathematics and science homework is coded as follow for each subject: 0 = never, 1 = less than once a week, 2 = one or two times a week, 3 = three or four times a week, 4 = every day.

School Level Control Variables

The total enrolment of students was divided into hundreds. A Percentage of students from an economically disadvantaged home was coded as follows: 1 = 0 to 10%, 2 = 11 to 25%, 3 = 26 to 50%, 4 = more than 50%. The immediate area in which the school was located was coded as

follows: 1 = small town, 2 = medium size city, 3 = suburban, 4 = urban. The income level of the school's immediate area was coded as follows: 1 = low, 2 = middle, 3 = high. Class size was the number of students in the class. Different types of schools (only for eighth grade) were coded as follows: 1 = private/national, 0 = public. All the questions were answered by a school principal. *School-P* is a variable that shows the average of the level of schooling of the parents whose children study in the same school. The variable was created by the following steps. First, level of schooling of both the mother and the father were coded according to the following scores: 1 = elementary school or did not complete any school, 2 = lower-secondary school, 3 = upper-secondary school, 4 = junior college, 5 = university or college, and 6 = graduate school. Second, the score of both parents were summed up and the average of those numbers was presented for each school. A variable for missing value (*unknown*) was created and not considered in the calculation of *School-P*.

1.5.3 Estimation Method

Due to the sampling procedure used in TIMSS 2011, weighted multilevel model and weighted multilevel ordered logit model, and weighted multilevel logit model analysis were conducted according to each independent variable. The analysis was conducted with students representing the level-1 units and schools representing level-2 units. Since the data structure is hierarchical, students within same school may share similarities and it must be considered in the analytic methods. Multilevel model examines the variance between individuals and groups and it gives an accurate estimate when examining nested data (Heck and Thomas, 2015). Below is the equations used for the estimation:

Level-1: $Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + \varepsilon_{ij}$ (1)

Level-2: $\beta_{0j} = \gamma_{00} + \gamma_{01}S_j + \gamma_{02}Z_j + u_{0j}$ (2)

Where:

Y_{ij} = students' perception of frequency of parental involvement of students *i* in school *j*

β_{0j} = intercept for the *j*th school

S_j = school outreach

X_{ij} = vector of the student level control variables

ε_{ij} = residual term that reflects individual student differences around the mean of school *j*

γ_{00} = grand mean of all the school means

Z_j = vector of the school level control variables

u_{0j} = school-level residual term

Eq. (2) into Eq. (1) yields the combined equation below:

$$Y_{ij} = (\gamma_{00} + \gamma_{01}S_j + \gamma_{02}Z_j + u_{0j}) + \delta X_{ij} + \varepsilon_{ij} \quad (3)$$

The multilevel model shown in Eq. (3) was estimated to analyse whether informative school outreach is associated with home-based parental involvement. These models are statistically controlled by student and school background variables.

1.5.4 Descriptive Statistics

Table 1.2 provides weighted descriptive statistics for each grade. The proportion of parents that do not engage in any types of involvement is not negligible. For fourth grade, about 4% and for eighth grade, about 10% of parents do not engage in any types of home-based involvement. Parents' highest levels of education were measured only for the eighth grade. Among mothers, 3% completed elementary school or did not graduate from any school, 33% completed junior high school, 22% completed junior college, 16% graduated from university, college, or graduate school, and 26% lists as unknown. As for to fathers, 4% completed

elementary school or did not graduate from any school, 26% completed junior high school, 8% completed junior college, 28% graduated from university, college, or graduate school, and 33% lists as unknown.

1.6 Results

Fourth Grade

Table 1.3 shows the eight models that estimate effects of informative school outreach on each variable that measures home-based parental involvement. Model 1 to 4 are estimated with a weighted multilevel ordered logit model, model 5 to 7 are estimated with a weighted multilevel model, and finally model 8 is estimated with a weighted multilevel binary logit model.

Informing about school is positively associated with all the variables of parental involvement. That is when parents tend to get more involved as they receive school information. On the other hand, informing about students is not significantly associated with most variables and is negatively associated with *Monitoring* and *Pi0*.

Since it is especially important to make parents who do not practice parental involvement to do it, marginal effects of informative school outreach about school on *Pi0* was calculated: the probability that parents get involved in at least one type of the involvement increases by 0.2% point when the frequency of informing parents about overall academic achievement increases by one point, 0.2% point when the frequency of informing parents about school accomplishments increases by one point, 0.6% points when the frequency of informing parents about the educational goals and pedagogic principles of the school increases one point, and 0.3% points when the frequency of informing parents about the rules of the school increases one point. Results also indicate that increasing the frequency of informing parents about the educational goals and pedagogic principles of the school is the most effective among the four

types of information about school to prevent negligence.

As for the student level variables, parents tend to communicate with their children about school more and are more likely to engage in at least one type of involvement when their child is female (*Ask*, *Talk,Communicating,* and *PI0*). SES variables are largely related to parental involvement. The number of possessions at home is positively associated with all home-based parental involvements. Likewise, the numbers of books at home are also positively associated with most variables except for *Pi0*.

On the school level variable, the income level of school area and class size is largely associated with parental involvement. The higher income level of school area is negatively associated with *Ask*, *Check*, *Communicating*, *Pi4* and *Pi0*. Larger class size is negatively associated with most variables except *Ask* and *Time*. Other variables do not show significant association largely. The total enrolment of students in hundreds is positively associated with *Talk* and *Pi0*. A higher percentage of students from economically disadvantaged homes is negatively associated with *Pi0*. Also, when schools locate in bigger cities, parents tend to *Ask* more.

Eighth Grade

Table 1.4 shows the results of the estimation for eighth grade. The same as for fourth grade, model 1 to 4 are estimated with a weighted multilevel ordered logit model, model 5 to 7 are estimated with a weighted multilevel model, and finally model 8 is estimated with a weighted multilevel binary logit model.

School outreach about learning progress is positively associated with all the types of home-based parental involvement. However, a frequency of informing about behaviour and well-being of children is negatively associated with *Ask*, *Talk*, *Communicating*, and *Pi4*. Also, informing about school is negatively associated with *Ask* even though it is not significantly

associated with the others.

Since it is especially important to make parents that do not practice parental involvement to do it, marginal effects of informative school outreach about learning progress on *Pi0* was calculated: the probability that parents get involved in at least one type of the involvement increases by 2.1% point when the frequency of informing parents about their child's learning progress increases by one point.

As student level variables, as with the fourth grade, parents are more likely to get involved and communicate when their child is female. Also, SES variables are largely associated with parental involvement except for mothers' educational level. The number of books is positively associated with most of the parental involvement except for *Time*. The number of possessions at home is positively associated with all the types of home-based parental involvement. A higher level of parents' education is positively associated with home-based parental involvement in large. However, the tendency is relatively weak for mothers' educational level. While a higher level of education is positively associated with *Ask*, *Time*, *Monitoring*, and *Pi4*, there are no significant associations between *Talk, Check, Communicating,* and *Pi0*. When children do not know their mothers' educational level, it is negatively associated with *Talk* but positively related to *Time* and *Monitoring*. Frequency of mathematics and science homework is positively associated with all the types of involvement.

As for school level variables, the higher percentage of economically disadvantaged students in the school is negatively associated with the involvement except for *Ask*. As other variables, total enrolment of students is positively associated with *Ask, Talk, Communicating,* and *Pi0*. Larger area of school location is negatively associated with *Ask, Communicating*, and *Pi0*. Private or national school is negatively associated with most of the involvement except for *Talk, Communicating* and *Pi0*. Higher income level of the school's immediate area is negatively associated except for *Ask* and *Pi0*. Larger class size is negatively associated with *Talk*. Higher

level of the schooling of the parents whose children study in the same school (*School-P*) is positively associated with *Ask, Time, Monitoring* and *Pi4*.

1.7 Discussion

The present study investigates effects of informative school outreach on home-based parental involvement elementary and middle schools separately. Results reveal that different types of informative school outreach have different effects depending on whether the student is in the fourth or eighth grade. Association of home-based parental involvement with informative school outreach, students and school level variables are discussed.

Home-based Parental Involvement and its Association with Informative School Outreach

For fourth grade, informing about school is positively associated with home-based parental involvement. On the other hand, as it is hypothesised, informing about the learning progress had the similar effect for eighth grade. These factors also positively influence parents who do not engage in any involvement. The effects of informative school outreach are robust as they are significant on both multidimensional and separate measures of home-based parental involvement.

However, for elementary school, informing about students and, for middle school, informing about behaviour and well-being of students are negatively associated with some variables. The results are consistent with Simon (2004). She refers that parents of children with attendance or behaviour problems reported more school contacts about children's attendance and behaviour. Likewise, the same reason is considered for the negative result, and schools tend to inform parents about behaviours and well-being of students more frequently especially when there are more children that have problems.

The differences in results between elementary and middles school may reflect the parents'

focus of concern at different school levels of their children. Parents of elementary school children tend to be more concerned about their children's relationships with other friends, and behaviour of everyday life rather than their academic achievement (Benesse Educational Research and Development Institute, 2011). Schools could play an important role in encouraging parents of younger children to place more importance on education by informing them about school matters, such as rules and educational goals. Information about the school such as rules or educational goals would make them aware of what they are supposed to do in relation to their children's schooling; namely, parental role construction, and prompt them to engage more in their education.

On the other hand, parents of middle school children tend to care more about their children's education (Benesse Educational Research and Development Institute, 2011). In Japan, due to competitive high school entrance exams, information about educational progress becomes imperative to parents of middle school children. Even if parents are less concerned about education, frequent information about learning progress can make them aware of the importance of education and high school entrance examinations. Since working-class mothers tend to rely more on teachers for their children's education (Lareau, 1987; Yamamoto, 2015), some parents might think their children are doing well and might not consider the necessity to get involved if they do not receive any information at all. Therefore, receiving information about the learning progress prompt parents to get involved and try to lend their support.

Home-based Parental Involvement and its Association with Student Level Variables

On individual levels, results show that regardless of school level, when children are female, parents tend to get involved more, especially in the communicating type of involvement. Parents' SES, especially economic resources, is largely associated with home-based parental involvement. However, parents' educational level, which is examined only for the eighth grade

because of the limited data, show different tendencies between mothers' and fathers' educational level.

In large, a higher level of fathers' education is associated with more parental involvement, while the mothers' educational level is not significantly associated with some types of involvement. A higher level of mothers' education is relatively associated with stricter parenting style such as enforcing discipline and routines (*Monitoring* and *Time*), which is consistent with previous studies (Yamamoto, 2015; Honda, 2008). However, it is not significantly associated with *Check*. It suggests that, in general, mothers hope that their children finish their homework regardless of their educational level. In addition to this, results also suggest that mothers with a higher level of education expect their children to develop learning habits through making sure that their children set aside time for their homework as it was also pointed out by Yamamoto (2015).

As for communicating types of involvement, *Talk* is not significantly associated with mothers' educational level, but *Ask* is associated with a higher level of it. Yamamoto (2015) argues that the working-class mother is less likely to know how to intervene effectively to improve their children's academic performance. It is assumed that mothers with lower educational level may hesitate to initiate to ask or do not know how they should ask about those topics because they feel they lack knowledge or self-efficacy to understand what their children learn at school.

Frequency of mathematics and science homework is significantly and positively associated with all the types of involvement. Since it is also associated with communicating types of involvement, it is suggested that it gives opportunities to parents to communicate with their children about school related matters.

Home-based Parental Involvement and its Association with School Level Variables

School level characteristics that influence parental involvement have somewhat different impacts on elementary and middle school. Higher percentage of economically disadvantaged students is negatively associated with all the measures for middle school but only with *Pi0* for elementary school. The possible reason for the negative effects is that information is less likely to be accessible for the parents whose children go to schools with a higher concentration of economically disadvantaged students and it affects to the parents of children in middle school more than in elementary school.

Lareau (1987) points out that parents whose children attend school in middle-class communities tend to socialize with other parents in school environments, such as school events, much more than those in working-class communities. The former receives more information regarding education, school and children compared to the latter, and which may affect the level of parental involvement positively.

In addition to the difficulty of keeping up with more advanced level of studies, parents of children in middle school need specific information regarding high school selection to be able to get involved in their children's education; for example, information about entrance examinations and how to choose the appropriate high school. Necessary information to select high school differs depending on where the family resides, since it is selected based on the commuting distance from the area the family lives in. If there are more parents who socialise with each other in or around school, it establishes information exchange networks and especially when the information varies by locality, the parents are more likely to get useful information there. On the other hand, educational information related to elementary school children is more general, and parents can still get it from different sources. Therefore, the percentage of economically disadvantaged students can be more influential for middle school since it can change the amount of the specific information that the parents can get.

It is also possible that when a school consists of a large percentage of students from economically disadvantaged homes, the school may not give as much information as other schools with a higher concentration of middle-class students. Usually, higher SES parents tend to have higher educational expectations, which is how far in school parents expect their children to advance (e.g., Park and Holloway, 2013; Galindo and Sheldon, 2012). Accordingly, they are prone to demand more from the schools than their lower counterparts. Schools would respond to this and offer more information. As a result, it prompts parents to get more involved.

A higher income level in the school area is negatively associated with parental involvement for both fourth and eighth grades. It is likely that school neighbourhoods overlap with the family neighbourhood. Taking into this account, the result is consistent with Bhargava and Witherspoon (2015). They found that parents engage in more home-based involvement if they live in more disadvantaged neighbourhoods to protect their children from negative influences.

A larger class size is more negatively associated with parental involvement for fourth grade than eighth grade. The negative influence of larger class size is in line with previous studies (Datar and Mason, 2008; Bonesrønning, 2004). One of explanations for this is that when children are still young, school-child-parent communication would be smoother in smaller classes. For example, Blatchford and his colleagues (1997) examined effects of class size on a teaching of pupils aged 7 – 11 years and found that pupils in smaller classes got more individual attention and better quality of teaching. Usually, pupils play a role to convey information from schools such as handing letters or a communication notebook to their parents. Since children in smaller classes get more attention from teachers compared to those in a larger one, they are less likely to misunderstand information that they are supposed to tell their parents. As a result, school-child-parent communication becomes smoother in smaller classes and the parents would get more frequent or more accurate information that, in turn, prompts

involvement.

Limitations

Because of lack of data, the present study is unable to control the education level of parents of fourth grade students. To see how the results change without controlling it, the models of eighth grade without controlling parents' educational level were also estimated. The results were very similar to Table 1.4 and informing about the learning progress is positively associated with all the variables of involvement. Since this study uses cross-section data, it is not possible to analyse the causal relationships. For example, concerning the explanation presented by Simon (2004) for the negative results, it is impossible to analyse whether it applies to this case or not. Further study using panel data is needed in order to test that explanation.

1.8 Conclusion

The study investigated the effects of school outreach on parental involvement. Samples of elementary and middle school children were analysed separately using a weighted multilevel model. The results show that the associations are different according to the levels of school among the children. For the sample of elementary school children, informing about school is positively associated with home-based parental involvement. On the other hand, informing about children's learning progress is positively associated with it for middle school.

This study addressed gaps in the literature on parental involvement making an important contribution by showing the effects of informative school outreach and the importance of taking into account the school levels. The results of the study suggest that schools and educators can increase the frequency of parental involvement through implementing the practices according to the school level.

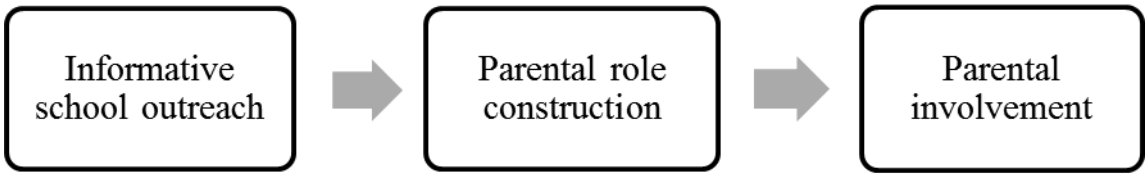


Figure 1.1 A Model of Influences of Informative School Outreach on Parental Involvement

Table 1.1 Factor Analysis for Informative School Outreach

	Factor 1: Informing about school	Factor 2: Informing about students
Fourth grade		
Inform parents about their child's learning progress	-0.063	0.810
Inform parents about the behaviour and well-being of their child at school	0.080	0.849
Inform parents about the overall academic achievement of the school	0.437	0.071
Inform parents about school accomplishments	0.444	0.254
Inform parents about the educational goals and pedagogic principles of the school	0.739	0.058
Inform parents about the rules of the school	0.570	-0.186
Eighth grade		
Inform parents about the overall academic achievement of the school	0.494	
Inform parents about school accomplishments	0.438	
Inform parents about the educational goals and pedagogic principles of the school	0.754	
Inform parents about the rules of the school	0.806	

Table 1.2 Weighted Descriptive Statistics

(Eighth grade: N = 4,132 students and 133 schools, Fourth grade: N = 3,939 students and 140 schools)

	Eighth Grade				Fourth Grade			
Variable	Mean or %	Std. Dev.	Min	Max	Mean or %	Std. Dev.	Min	Max
Dependent variables								
(Ask)Parents ask a student what you learned in school	2.31	0.98	1	4	2.59	1.03	1	4
(Talk)A student talks about schoolwork with parents	2.49	0.97	1	4	2.80	1.03	1	4
(Time)Parents make sure that a student set aside time for homework	1.97	1.10	1	4	2.23	1.25	1	4
(Check)Parents check if a student does homework	2.13	1.15	1	4	2.99	1.18	1	4
(Pi0)Parents who engage in at least one type of home-based involvement	0.90		0	1	0.96		0	1
Independent variables								
Inform parents about their child's learning progress	3.21	0.70	1	4	3.56	0.57	1	4
Inform parents about the behavior and well-being of their child at school	3.37	0.57	2	4	3.56	0.55	1	4
Inform parents about the overall academic achievement of the school	2.89	0.89	1	4	2.37	0.68	1	4
Inform parents about school accomplishments	3.55	0.67	1	4	3.37	0.74	1	4
Inform parents about the educational goals and pedagogic principles of the school	2.89	0.82	1	4	3.05	0.70	2	4
Inform parents about the rules of the school	2.89	0.79	2	4	2.73	0.71	2	4
Control variables								
Student level								
Female	0.50		0	1	0.50		0	1
Number of books at home	2.94	1.26	1	5	2.76	1.07	1	5
Possessions at home (a computer, a desk etc.)	7.78	1.66	0	11	7.95	1.81	1	11
Possessions at home11	0.04		0	1	0.06		0	1
Highest level of education completed by mother								
Lower-secondary school, elementary school or did not complete a school	0.03		0	1				
Upper-secondary school	0.33		0	1				
Junior college	0.22		0	1				
University, college, or graduate school	0.16		0	1				
Unknown	0.26		0	1				
Highest level of education completed by father								
Lower-secondary school, elementary school or did not complete a school	0.04		0	1				
Upper-secondary school	0.26		0	1				
Junior college	0.08		0	1				
University, college, or graduate school	0.28		0	1				
Unknown	0.33		0	1				
Frequency of mathematics homework	1.68	1.16	0	4				
Frequency of science homework	0.98	0.94	0	4				
School level								
Total enrolment of students (in hundreds)	3.54	2.25	0.45	11.1	3.53	2.39	0.17	11.1
Percentage of students from economically disadvantaged home	1.84	0.88	1	4	1.62	0.72	1	4
Location	2.29	0.95	1	4	2.24	1.08	1	5
Income level of school's immediate area	1.82	0.57	1	3	1.88	0.45	1	3
Class size	30.06	5.48	16	46	24.42	8.52	4	39
Type of school	0.09		0	1				
School-P	7.48	0.71	6.38	9.44				

Table 1.3 Results for Fourth Grade

VARIABLES	1 Ask	2 Talk	3 Time	4 Check	5 Communicating	6 Monitoring	7 Pi4	8 Pi0
Female	0.329***	0.481***	0.0643	-0.0247	0.247***	0.00270	0.131***	0.547***
	(0.063)	(0.061)	(0.062)	(0.064)	(0.050)	(0.044)	(0.032)	(0.169)
Number of books at home	0.131***	0.119***	0.119***	0.131***	0.0942***	0.0788***	0.0712***	0.162
	(0.033)	(0.036)	(0.032)	(0.031)	(0.027)	(0.022)	(0.018)	(0.124)
Possessions at home	0.200***	0.150***	0.138***	0.0854***	0.122***	0.0676***	0.0845***	0.226***
	(0.020)	(0.020)	(0.020)	(0.019)	(0.014)	(0.013)	(0.010)	(0.056)
Possessions at home11	0.0951	0.273*	0.123	0.0466	0.0705	0.126	0.0718	-0.222
	(0.138)	(0.140)	(0.158)	(0.155)	(0.102)	(0.109)	(0.063)	(0.465)
School level								
Total enrolment of students (in hundreds)	0.00163	0.0403**	0.0110	0.0173	0.0176	0.0122	0.0121	0.116*
	(0.020)	(0.020)	(0.020)	(0.024)	(0.014)	(0.013)	(0.010)	(0.068)
% of economically disadvantaged students	-0.0775	0.0338	-0.0514	-0.0549	-0.0106	-0.0414	-0.0173	-0.318*
	(0.056)	(0.063)	(0.075)	(0.069)	(0.041)	(0.045)	(0.029)	(0.177)
Location of school	0.104**	0.0250	0.00171	0.0789	0.0432	0.0322	0.0316	0.175
	(0.043)	(0.043)	(0.063)	(0.057)	(0.030)	(0.040)	(0.021)	(0.128)
Income level of school area	-0.203**	-0.0929	-0.0821	-0.249**	-0.108*	-0.112	-0.0870*	-0.482*
	(0.081)	(0.096)	(0.113)	(0.110)	(0.062)	(0.070)	(0.046)	(0.277)
Class size	-0.00506	-0.0243***	-0.0147	-0.0132*	-0.0113*	-0.0126**	-0.00930**	-0.0904***
	(0.007)	(0.009)	(0.010)	(0.008)	(0.006)	(0.006)	(0.004)	(0.025)
Informative school outreach								
Informing about student	-0.0214	-0.0620	-0.0898	-0.0741	-0.0426	-0.0746*	-0.0430	-0.295*
	(0.039)	(0.057)	(0.085)	(0.056)	(0.034)	(0.045)	(0.028)	(0.174)
Informing about school	0.103*	0.0972*	0.160**	0.133**	0.0848**	0.118***	0.0782***	0.336*
	(0.053)	(0.057)	(0.070)	(0.065)	(0.039)	(0.043)	(0.029)	(0.187)
Constant					-1.006***	-0.258	-0.615***	4.390***
					(0.254)	(0.254)	(0.176)	(0.994)
cut1	0.231	-0.686*	0.606	-1.151***				
	(0.347)	(0.358)	(0.370)	(0.365)				
cut2	1.364***	0.598*	1.215***	-0.458				
	(0.345)	(0.357)	(0.369)	(0.367)				
cut3	3.139***	2.098***	2.006***	0.370				
	(0.346)	(0.357)	(0.367)	(0.367)				
Level-2 variance (schools)	0.136***	0.116***	0.168***	0.171***				1.090***
	(0.023)	(0.020)	(0.032)	(0.030)				(0.305)
Log of level-2 variance (schools)					-1.759***	-1.654***	-2.019***	
					(0.161)	(0.164)	(0.148)	
Log of level-1 variance (students)					0.172***	0.160***	-0.205***	
					(0.011)	(0.014)	(0.014)	
Observations	3939	3939	3939	3939	3939	3939	3939	3939

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 1.4 Results for Eighth Grade

VARIABLES	1 Ask	2 Talk	3 Time	4 Check	5 Communicating	6 Monitoring	7 Pi4	8 Pi0
Female	0.182***	0.591***	0.0803	0.00183	0.326***	0.0433	0.0780*	0.544***
	(0.062)	(0.062)	(0.071)	(0.062)	(0.041)	(0.064)	(0.044)	(0.120)
Number of books at home	0.118***	0.112***	0.0397	0.0655***	0.0748***	0.0374*	0.0341***	0.125**
	(0.027)	(0.025)	(0.028)	(0.025)	(0.018)	(0.021)	(0.013)	(0.053)
Possessions at home	0.169***	0.160***	0.152***	0.0574**	0.127***	0.0737***	0.0700***	0.114***
	(0.024)	(0.022)	(0.023)	(0.024)	(0.019)	(0.015)	(0.010)	(0.043)
Possessions at home11	-0.0602	-0.0963	-0.000415	0.329*	0.0170	0.212	0.121	-0.133
	(0.179)	(0.169)	(0.174)	(0.192)	(0.144)	(0.192)	(0.136)	(0.391)
Ref: Lower than lower-secondary								
Mother: Upper-secondary school	0.251	0.0564	0.346	0.128	0.0821	0.158	0.117	-0.196
	(0.209)	(0.165)	(0.245)	(0.229)	(0.162)	(0.141)	(0.095)	(0.331)
Mother: Junior college	0.400*	0.124	0.426*	0.310	0.133	0.256*	0.185*	0.193
	(0.214)	(0.181)	(0.246)	(0.240)	(0.173)	(0.152)	(0.102)	(0.341)
Mother: Higher then University	0.484**	0.196	0.489**	0.360	0.244	0.301*	0.230**	0.223
	(0.228)	(0.193)	(0.245)	(0.249)	(0.184)	(0.157)	(0.109)	(0.370)
Mother: Unknown	-0.00843	-0.358*	0.473*	0.365	-0.207	0.285*	0.138	-0.443
	(0.220)	(0.183)	(0.242)	(0.239)	(0.182)	(0.156)	(0.097)	(0.357)
Father: Upper-secondary school	0.434***	0.514***	0.666***	0.597***	0.379***	0.384***	0.299***	0.589**
	(0.158)	(0.165)	(0.186)	(0.155)	(0.124)	(0.095)	(0.062)	(0.278)
Father: Junior college	0.545***	0.562***	0.637***	0.699***	0.327	0.338**	0.248**	0.605*
	(0.189)	(0.213)	(0.208)	(0.189)	(0.209)	(0.136)	(0.102)	(0.340)
Father: Higher then University	0.570***	0.658***	0.642***	0.552***	0.502***	0.293***	0.257***	0.902***
	(0.172)	(0.175)	(0.186)	(0.162)	(0.156)	(0.108)	(0.081)	(0.324)
Father: Unknown	0.322**	0.333**	0.312*	0.320**	0.328**	0.146*	0.141**	0.396
	(0.163)	(0.170)	(0.179)	(0.150)	(0.146)	(0.086)	(0.059)	(0.297)
Frequency of mathematics homework	0.122***	0.101***	0.134***	0.152***	0.0568**	0.0846***	0.0586***	0.114*
	(0.035)	(0.032)	(0.041)	(0.039)	(0.024)	(0.028)	(0.019)	(0.062)
Frequency of science homework	0.201***	0.205***	0.165***	0.163***	0.0686*	0.0785**	0.0597***	0.353***
	(0.048)	(0.045)	(0.045)	(0.043)	(0.038)	(0.038)	(0.022)	(0.093)
School level								
Total enrolment of students (in hundreds)	0.0433**	0.0540**	0.0359	0.0219	0.0350**	0.0162	0.0160	0.0738*
	(0.022)	(0.023)	(0.025)	(0.023)	(0.014)	(0.016)	(0.011)	(0.040)
% of economically disadvantaged students	-0.0458	-0.144***	-0.114*	-0.149**	-0.0925***	-0.103**	-0.0759***	-0.237**
	(0.063)	(0.051)	(0.059)	(0.063)	(0.036)	(0.042)	(0.027)	(0.104)
Location of school	-0.124**	-0.0633	-0.0315	0.0264	-0.0691*	0.00657	-0.0101	-0.151*
	(0.060)	(0.050)	(0.051)	(0.063)	(0.036)	(0.040)	(0.028)	(0.078)
Private or national school	-0.386**	-0.267	-0.717***	-0.564***	-0.137	-0.390**	-0.263**	-0.473
	(0.192)	(0.194)	(0.254)	(0.196)	(0.134)	(0.157)	(0.112)	(0.417)
Income level of school area	-0.157	-0.193*	-0.196*	-0.194*	-0.157**	-0.149**	-0.116**	-0.112
	(0.104)	(0.105)	(0.106)	(0.112)	(0.074)	(0.076)	(0.054)	(0.196)
Class size	0.0122	-0.0184**	0.0128	-0.00495	-0.00617	-0.000272	-0.000495	0.00266
	(0.010)	(0.009)	(0.014)	(0.010)	(0.006)	(0.008)	(0.005)	(0.025)
School-P	0.133*	0.122	0.245***	0.115	0.0576	0.117*	0.0855**	0.0165
	(0.078)	(0.078)	(0.089)	(0.088)	(0.050)	(0.064)	(0.044)	(0.143)
Informative school outreach								
Informing about learning progress	0.169**	0.203***	0.242***	0.201***	0.123***	0.158***	0.118***	0.256***
	(0.078)	(0.067)	(0.076)	(0.074)	(0.044)	(0.049)	(0.035)	(0.097)
Informing about behaviour and well-being	-0.189**	-0.205***	-0.112	-0.102	-0.143***	-0.0748	-0.0688*	-0.0688
	(0.083)	(0.073)	(0.084)	(0.080)	(0.051)	(0.054)	(0.038)	(0.126)
Informing about school	-0.0984**	-0.0237	-0.0235	-0.0170	-0.0329	-0.00714	-0.0106	-0.0791
	(0.045)	(0.047)	(0.051)	(0.048)	(0.027)	(0.034)	(0.023)	(0.084)
Constant					-1.633***	-2.160***	-1.678***	-0.108
					(0.505)	(0.669)	(0.423)	(1.468)
cut1	2.479***	0.843	4.733***	2.017**				
	(0.712)	(0.717)	(0.930)	(0.934)				
cut2	3.833***	2.411***	5.620***	2.833***				
	(0.706)	(0.716)	(0.924)	(0.936)				
cut3	5.828***	4.306***	6.774***	3.941***				
	(0.717)	(0.726)	(0.924)	(0.947)				
Level-2 variance (schools)	0.143***	0.150***	0.179***	0.157***				0.378***
	(0.023)	(0.023)	(0.027)	(0.022)				(0.089)
Log of level-2 variance (schools)					-1.943***	-1.632***	-1.992***	
					(0.218)	(0.154)	(0.159)	
Log of level-1 variance (students)					0.177***	0.217***	-0.152***	
					(0.011)	(0.013)	(0.012)	
Observations	4132	4132	4132	4132	4132	4132	4132	4132

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Chapter 2: Effects of Parental Involvement on Academic Achievement among Elementary and Middle School Students

2.1 Introduction

Enhancing children's academic achievement is an important concern for parents, teachers, and policymakers. To achieve higher achievement, it is essential to identify the factors that influence it. Parents are essential in children's daily lives and they play a significant role in their children's education. Hoover-Dempsey and Sandler (1995) states that parental involvement influences educational outcome through three mechanisms: modelling of school related behaviours and attitudes, reinforcing specific aspects of school learning, and instruction. Also, researchers actively encourage parental involvement to increase academic performance (e.g., Hoover-Dempsey et al., 2005; Blazer, 2009; Galindo and Sheldon, 2012).

Academic research, however, does not agree on the effects of the relationship. While there are studies that conclude that home-based parental involvement in children's education has positive impacts on school achievement (e.g., Wang and Sheikh-Khalil, 2014; Pong, 1997; Fantuzzo et al., 2004; McNeal, 2015; Castro et al, 2015), other studies show insignificant or negative effects (e.g., Domina, 2005; Shumow and Miller, 2001; Shumow et al., 2011; Galindo and Sheldon 2012), or mixed results (McNeal, 1999, 2014; Zhan, 2006; Fan, 2001; Ginsburg and Bronstein, 1993; Sui-Chu and Willms, 1996; Lee and Bowen, 2006). The discrepant results are attributed to several factors such as different measures of parental involvement, disregard

for school levels (e.g., elementary and middle school) and gender, failure to capture indirect effects of parental involvement, and the inclusion of different school subjects within a single variable for academic outcome (e.g., Math and Reading). Understanding how parental involvement influences academic achievement will inform and help policymakers and schools to design more effective parental involvement strategies. Therefore, the estimates of its effects should be as accurate as possible.

The present study examines the effects of parental involvement on mathematics and science achievement using data from Trends International Mathematics and Science Study (TIMSS) 2011. The unique contribution of this study is that it addresses the gaps pointed out above and obtain better estimators by comparing the effects of parental involvement across three criteria: elementary and middle school (school level), male and female (gender), and math and science (subject). The findings reveal that even though both male and female students benefit from parental involvement regardless of the school level, the association between monitoring types of involvement and achievement is different between elementary and middle school. Also, the effects of monitoring on achievement and attitudes are more significant among elementary than middle school students, which suggests that elementary students reap more benefits more from it.

2.2 Definition of Parental Involvement

Parental involvement includes a range of practices by the parent toward their children that are intended to promote the latter's motivation and educational achievement such as discussing school with children and monitoring children's progress. Parental involvement is multidimensional, and that has made it difficult to define it (Hill and Taylor, 2004). For example, Epstein (2001) suggests six categories of involvement: parenting, communicating, volunteering, learning at home, decision making, and collaborating within the community.

Grolnick and Sowiaczek (1994) describe three categories of involvement: behaviour, cognitive-intellectual, and personal.

Most commonly, parental involvement is categorised in home-based and school-based involvement (e.g., Hoover-Dempsey and Sandler, 1997; Galindo and Sheldon, 2012; Deslandes and Bertrad, 2005; Green and Walker, 2007; Pomerantz et al., 2007; Anderson and Minke, 2007; Dauber and Epstein, 1989; Shumow and Miller, 2001). School-based involvement includes practices taking place at school; for example, attending school events and conference, and volunteering. Home-based involvement is related to practices taking place outside of school such as learning activities at home, reviewing the child's work, monitoring their progress, helping them with homework, and discussions about school events (Hoover-Dempsey and Sandler, 1997; Pomerantz et al., 2007).

The present study adopts the home-based versus school-based categorization. However, since school-based involvement can be dramatically affected by external reasons which cannot be controlled by this study (e.g., nonflexible work schedule of parents), it is not used as a measure of parental involvement. Home-based involvement does not have such related problems and should be a better indicator of the actual outcomes. In this study, home-based involvement includes *communication with children about schoolwork* (communicating) and *monitoring their homework* (monitoring). Communicating and monitoring are commonly used as measures of parental involvement (e.g., McNeal, 2014; Sui-Chi and Willms, 1996). They are examined both as part of multidimensional index and as separate variables. This is because even though parental involvement is a multidimensional, the inclusion of too many measures (e.g., checking children's homework to talking about school) could make it hard to interpret its effects.

2.3 Literature Review

Even though a number of studies investigated the effects of parental involvement on academic achievement, five important gaps that prevent a more comprehensive understanding of the matter remain unaddressed: 1) previous studies use different definitions of parental involvement, 2) previous studies do not take school subjects into account separately, 3) previous studies do not consider school levels, 4) previous studies do not consider mediation effects, 5) previous studies do not consider gender difference. The details about those gaps in literature are discussed below.

2.3.1 Effects of Home-based Parental Involvement on Academic Achievement

A number of studies have examined the effects of home-based parental involvement on educational achievement, showing inconsistent results. While some studies showed a positive association between the two (e.g., Wang and Sheikh-Khalil, 2014; Pong, 1997; Fantuzzo et al., 2004; McNeal, 2015; Castro et al, 2015), other studies showed insignificant, negative, (e.g., Domina, 2005; Shumow and Miller, 2001; Shumow et al., 2011; Galindo and Sheldon 2012), or mixed results (McNeal, 1999, 2014; Zhan, 2006; Fan, 2001; Ginsburg and Bronstein, 1993; Sui-Chu and Willms, 1996; Lee and Bowen, 2006). For example, Wang and Sheikh-Khalil (2014) found that home-based involvement is positively associated with GPA. On the other hand, Shumow and Miller (2001) reported a negative association between home-based parental involvement and GPA and academic achievement. Finally, Shumow, et al. (2011) did not find a significant relationship between home-based involvement and science grades.

One possible reason for the inconsistent results is that studies employ different measures and definitions of parental involvement. While some studies used a single measure of parental involvement (e.g., Domina, 2005) or a measure composed of similar types of involvement (e.g., Pong, 1997; Sui-Chu and Willms, 1996; Fan, 2001; Jung and Zhang, 2016; Plunkett et al., 2009),

others used an index that includes various types of involvement, from setting aside time for children to do homework to visiting museums (e.g., Galindo and Sheldon, 2012; Wang and Sheikh-Khalil, 2014). Using a measure that includes various types of involvement make it difficult to interpret the precise effects of a particular measure (Sui-Chu and Willms, 1996) and it can also bring different results.

In addition to this, the results are also likely to differ depending on the subjects. For example, parental monitoring of homework is positively associated with a reading achievement, but is negatively or not significantly associated with a mathematics achievement (Zhan, 2006; Sui-Chu and Willms, 1996). Therefore, it is also important to take into account the outcome variables to understand the effects of parental involvement precisely.

2.3.2 School Level

How parents get involved and the effects of their involvement may differ depending on the children's school level (Hill and Taylor, 2004; Patall et al., 2008). For example, middle school students preparing for high school entrance exams, and elementary school students learning basics are likely to receive different types of involvement. Also, compared to elementary school students, middle school students are more developed cognitively and have a higher sense of efficacy, hence their need for direct parental involvement decrease (Hill and Tyson, 2009). Likewise, when children get older, they become more peer-oriented and less interested in accepting obvious help (Hoover-Dempsey and Sandler, 1995).

Considering these results, the effects of parental involvement are likely to change according to the developmental changes. Hoover-Dempsey and Sandler (1995) claim that parental involvement must be appropriate for the child's development stage and be perceived as appropriate by the child to have a positive impact. In other words, the effects of monitoring may change according to school level because the necessity of direct involvement for older

children decreases over time. The problem is that previous studies bundled data of children from multiple school levels, making it impossible to identify these differences. Comparing results of different studies that analysed samples of children from a single school level could be a solution, but, this task is unpractical given that definitions and measurements differ dramatically across studies. Due to the reasons above, it is still unclear how parental involvement influences achievement across school levels.

There are only a few studies that investigated the association between parental involvement and academic achievement across the different school levels and they show different associations at different school levels. Muller (1998) found that talking about school with children is positively associated with mathematic scores in eighth grade but is insignificant for tenth grade. He also found gender-based differences: talking about school is associated positively with math scores of female tenth graders but negatively with the score of male tenth graders. However, the studies did not examine indirect effects of parental involvement on the score. On the other hand, Núñez et al. (2015) examined both direct and indirect effects of parental involvement in homework at different school levels and found different associations according to different school levels. Student homework behaviours (time spent on homework completion and homework time management) mediate the association between parental involvement in homework and academic achievement in middle and high school but not in elementary school. In addition to this, homework support was positively and directly associated with academic achievement at middle and high school but not at elementary school. However, their measurement of academic achievement is composed by several different subjects, which makes unclear how the effects of parental involvement vary across school subjects. The same can be said of gender differences.

2.3.3 Students' Attitude and Aspiration

Grolnick et al. (1991) suggested parental involvement has an impact on children's attitudes and motivation toward school rather than directly on academic achievement. Researchers argue that parents transmit their values to children by their involvement in activities with their children (e.g., Eccles et al., 1983; Grolnick and Slowiaczek, 1994). In other words, parent-child communication regarding education conveys the importance of schooling to the child (McNeal, 1999, 2014). When the parents talk to or ask their children about school, children are likely to notice the importance of it since their parents show interests toward it, and it influences the children's attitude towards education.

In fact, a number of empirical studies support the positive effects of parental involvement on children's attitude and motivation (Ginsburg and Bronstein, 1993; Simpkins et al., 2015; Spera, 2006; Gonzalez et al., 2002; Frenzel et al., 2010; Grolnick and Slowiaczek, 1994; Grolnick et al, 1991) and educational aspiration (Hill et al., 2004; Berzin, 2010; Hill and Wang, 2015; Frostick et al., 2016; McNeal, 2015). For example, Spera (2006) found that parental monitoring, defined as checking homework and keeping track of children's activities, is positively associated with their interest in school classes. Likewise, Simpkins et al. (2015) found that parental involvement in scientific subjects positively predicted the value adolescents placed on it. Hill and Wang (2015) found that monitoring, defined as providing clear and consistent guidelines and maintaining knowledge about youth's activities, is positively associated with educational aspiration.

In addition to this, accumulated research suggests that attitudinal and motivational variables such as attitude towards a subject (Lipnevich et al., 2016; Singh et al., 2002), enjoyment (García et al., 2016; Villavicencio and Bernardo, 2013), domain-specific values (Steinmayr and Spinath,2009), intrinsic motivation (Lloyd and Barenblatt, 1984) , and educational aspiration (Leung et al., 2010; Jung and Zhang, 2016) predict academic achievement and grades positively.

For example, García et al. (2016) found that enjoyment of mathematics predicted mathematics achievement positively among upper elementary school children. Also, Singh et al. (2002) found that mathematics attitude and interest predicted mathematics achievement positively, and science attitude and interest indirectly influences science achievement positively through enhancing academic time. Based on these findings, parental involvement is likely to influence academic achievement indirectly through affecting the children's attitudes and it is important to take these effects into account.

Some studies investigated the indirect effects of parental involvement on academic achievements through students' motivational resources, behaviour, and aspiration (Grolnick and Slowiaczek, 1994; Gottfried et al., 1994; Hill and Wang, 2015; Jung and Zhang, 2016; Grolnick et al., 1991; Wang and Sheikh-Khalil, 2014; Núñez et al., 2015). These studies largely found indirect positive effects of parental involvement through the mediating factors. For example, Wang and Sheikh-Khalil (2014) found that parental involvement influences GPA positively through enhancing educational engagement. Jung and Zhang (2016) found indirect effects of parental involvement on academic achievement through educational aspiration. However, most studies did not examine how associations differ across different school levels. How children perceive parental involvement may differ at different school level because of different senses of efficacy, different needs for direct parental involvement, and different cognitive development. Therefore, the associations between parental involvement, attitudes, and achievement may also differ at different school levels.

2.3.4 Students' Gender

It is likely that perception of parental involvement and its effects also vary among male and female children. Children face a number of unique developmental challenges especially in their

adolescence and gender affects how they manage all of these challenges (Perry and Pauletti, 2011). For example, Frydenber and Lewis (1991) found that there is a difference between the ways in which boys and girls cope with demands and stress; girls seek more social support and are more likely than boys to focus on relationships. Also, girls experience higher pressure and demands from school than boys (Wiklund et al., 2012).

Few studies have focused on gender differences between parental involvement and academic achievement (Muller, 1998; Moon and Hofferth, 2016 ; Jung and Zhang, 2016). For example, Muller (1998) found that female students' learning of mathematics at grades 10 to 12 are associated more closely with verbal interaction and supportive involvement, whereas the male students' gains are associated with social control and guidance. Moon and Hofferth (2016) found that parental involvement at home benefited boys' reading and mathematics score but it did not have the same benefit for girls throughout all early elementary school years. However, the index of parental involvement used in the study was composed by items focused on only daily living activities such as frequency of telling stories and playing games, and not school related involvement. Jung and Zhang (2016) examined 8-12 years old children and found that parental involvement, defined as the frequency of parental involvement in selecting courses, school activities, and things children study in class, predicted academic achievement positively among girls but did not find the significant direct effects for boys.

2.4 Purpose of the Present Study

The present study intends to address the gaps pointed out in the previous section by examining students in elementary and middle school separately utilising the same measurement of home-based parental involvement. Also, the study takes into account the indirect effects of parental involvement and examines whether students' educational attitude and aspiration mediate the associations between home-based parental involvement and mathematics and

science achievements. It also investigates male and female students separately. This study uses two measures for parental involvement: *communication with children about schoolwork* (communicating) and *monitoring their homework* (monitoring). Data for these two are taken from questionnaires that asked children about the frequency that they experience these involvements.

This study is organised around the following three research questions. 1) Do students' attitude and aspiration mediate the associations between home-based parental involvement and academic achievement? 2) How the associations vary between elementary and middle school? 3) Are the effects of parental involvement different between males and females? Based on the literature, it is hypothesised that parental involvement influences academic achievement positively through affecting student's attitude and aspiration (Figure 2.1) and that the associations would vary by the school level. Previous studies suggest that middles school students need less direct assistance compared to elementary students. Therefore, it is hypothesised that monitoring types of involvement is more significantly associated with elementary school students than middle school students. Also, since studies show that female children seek more social support (Lewis, 1991) and experience higher pressure and demands from school than boys (Wiklund et al., 2012), it is expected that communicating types of involvement would be more significantly associated with females than males.

2.5 Method

2.5.1 Data

This study uses the Japanese sub-sample from Trends International Mathematics and Science Study (TIMSS) 2011. The survey was conducted by the International Association for the Evaluation of Educational Achievement (IEA). TIMSS is an international assessment of student achievement in mathematics and science in the fourth and eighth grades. It also collects

a wide range of information from students, teachers and school principals. This study uses the Student and the School questionnaires. A two-stage random sample design was employed to collect the sample. Schools were sampled in the first stage and, from each school, one class was selected in the second stage. After deleting missing data, the data of this study arrived at a sample of 1,884 female students from 140 schools and 1,894 male students from 139 schools in fourth grade, and 1,812 female students from 133 schools and 1,789 male students from 131 schools in eighth grade.

2.5.2 Variables

Academic Achievement

Mathematics and science achievement is the mean score of student's achievement in mathematics and science from the five plausible values. Plausible values are academic achievement scores which are created based on item response theory. In TIMSS 2011 each student responded to only a portion of the assessment item pool. Therefore, the TIMSS scaling approach uses multiple imputation (plausible values) methodology to obtain students' scores (Foy et al., 2011). As a result, five plausible values were produced for each student.

Attitudes toward Mathematics and Science

Attitudes towards mathematics include six questions and attitudes towards science include seven questions from the student questionnaire. All of the questions began with "How much do you agree that…?" and the questions were: "you enjoy learning mathematics/science?"; "you wish you did not have to study mathematics/science?" (inverse); "mathematics/science is boring?" (inverse); "you learn many interesting things in mathematics/science?"; "you like mathematics/science?"; "it is important to do well in mathematics/science?"; and "read about science in your spare time?". Answer categories were coded as follows: 1 = disagree a lot, 2 =

disagree a little, 3 = agree a little, 4 = agree a lot. As for the third and the fourth question, the answer categories were coded inversely. Based on the questions, factor analysis was conducted separately for each gender and school levels. Factors with an eigenvalue greater than 1 were retained and it yielded a one-factor solution for all the groups and labelled as *attitudes toward mathematics* and *attitudes toward science*.

Educational Aspiration

The measure of educational aspiration was based on the question "How far in your education do you expect to go?" that was asked only to eighth graders. The responses are categorized according to years of schooling that students want to pursue as follows: 1 = lower than secondary school, 2 = technical college or junior college, 3 = university, 4 = graduate school.

Home-based Parental Involvement

As measures of home-based parental involvement, four questions from the student questionnaire that asked students to rate their perception of their parents' home-based involvement were used. The questions were asked and labelled as follow: "How often do your parents ask you what you learned in school?" (*Ask)*; "How often do you talk about your schoolwork with your parents?" (*Talk*); "How often do your parents make sure that you set aside time for your homework?" (*Time*); and "How often do your parents check if you do your homework?" (*Check*). Answer categories were coded as follows: 1 = Never or almost never, 2 = once or twice a month, 3 = once or twice a week, 4 = every day or almost every day.

Based on this, two component variables were also created. Among the four questions, *Ask* and *Talk* are more correlated (0.55 for female and 0.52 for male fourth graders and 0.62 for female and 0.6 for male eighth graders), as well as *Time* and *Check* (0.49 for female and 0.42

for male fourth graders and 0.73 for female and 0.67 for male eighth graders). Therefore, two composite measures were created by principal component analysis: *Communicating* (*Ask* and *Talk*) and *Monitoring* (*Time* and *Check*). The correlation between the variables of parental involvement is shown in Appendix A (Table A.1).

Control Variables

Several student and school variables were included in the models to control statistically for important background factors. The measure of socioeconomic status (SES) used in this study includes a number of books and materials related to educational well-being at home and the highest level of education completed by parents. The questions were answered by students. The number of books at home was coded as follows: 1 = 0-10 books, 2 = 11-25 books, 3 = 26-100 books, 4 = 101-200 books, 5 = more than 200 books. Index of possessions at home was created through adding eleven questions that ask if students have a specific item that is relevant to educational well-being (e.g., a computer and a desk for his/her own etc.). Since the distribution of addition of the eleven questions is not normal but truncated, a dummy variable was created to capture the effect of external value and it is labelled as *Possessions at home 11*. The highest level of education completed by the mother and father was asked but only to eighth grade students. Binary variables were created for each educational level for both the mother and the father. More than 30% of students in the sample did not know one of their parents' highest levels of education. Since it is too large to drop from the data, a dummy variable was created as unknown instead of dropping them from the data. It enables to control effects of parents' educational level while keeping the students that do not know it in the sample.

Studies show that children who are younger at school entry tend to perform worse academically (Lee and Fish, 2010; Kawaguchi, 2011). In Japan, school starts in April and children enter first grade of elementary school if, and only if they have completed six years of

life by April 1 of that year. In this study, in order to take into account for the effects of being younger in the classroom, a dummy variable was created for students born between January 1 and April and coded as 1 = yes and 0 = no.

Experiences of being bullied include six questions from the student questionnaire. All of the questions began with “During this year, how often…?” and the questions were: “were you made fun of or called names at school?”; “were you left out of games or activities by other students at school?”; “did someone spread lies about you at school?”; “was something stolen from you at school?”; “were you hit or hurt by other student(s) at school?”; and “were you made to do things you didn't want to do by other students at school?”. Factor analysis was conducted with the questions separately for each gender and school levels. Factors with an eigenvalue greater than 1 were retained and it yielded a one-factor solution for all the groups. The variable is used to control attitudes towards mathematics and science and educational aspiration since previous studies show that experience of being bullied is negatively associated with academic motivation (Skues et al., 2005: Young-Jones et al., 2015)

The total enrolment of students was divided into hundreds. A Percentage of students from economically disadvantaged homes was coded as follows: 1 = 0 to 10%, 2 = 11 to 25%, 3 = 26 to 50%, 4 = more than 50%. The immediate area in which the school was located was labelled as location of school and coded as follows: 1 = small town, 2 = medium size city, 3 = suburban, 4 = urban. The income level of the school's immediate area was coded as follows: 1 = low, 2 = middle, 3 = high. Class size is the number of students in the class. Different types of schools (only for eighth grade) were coded as follows: 1 = private/national, 0 = public. All the questions were answered by a school principal. *School-P* is a variable that shows the average of the level of schooling of the parents whose children study in the same school. The variable was created by the following steps. First, level of schooling of both the mother and the father were coded according to the following scores: 1 = elementary school or did not complete any school, 2 =

lower-secondary school, 3 = upper-secondary school, 4 = junior college, 5 = university or college, and 6 = graduate school. Second, the score of both parents were summed up and the average of those numbers was presented for each school. A variable for missing value (*unknown*) was created and not considered in the calculation of *School-P*.

All the control variables are used to control students' grade, attitude and aspiration except for experiences of being bullied that is only used to control attitude and aspiration. SES variables are also used to control parental involvement.

2.5.3 Estimation Method

Due to the sampling procedure used in TIMSS 2011, a weighted generalised multilevel structural equation model analysis (with an ordered logit link for estimating eighth graders educational aspiration) was conducted by Stata 14 to analyse the effects of parental involvement. Since the data structure is hierarchical, students within same school may share similarities and it must be considered in the analytic methods. Multilevel model examines the variance between individuals and groups and it gives accurate estimate when examining nested data (Heck and Thomas, 2015). Generalised structural equation modelling (GSEM) is a version of structural equation modelling (SEM) that allows for broader applications. SEM can depict relationships among variables by using various types of models and testing patterns of relationships among a set of observed and latent variables (Schumacker and Lomax, 2010). OLS regression is limited in that and it does not allow for simultaneous examination of multiple mediational chains (Bryan et al., 2007). SEM, on the other hand, examines direct and indirect effects simultaneously and tests multiple mediators, multiple dependent variables, complex mediational chains, and specific indirect effects within those complex chains (Bryan et al., 2007; Gunzler et al., 2013). Instrumental variables (IV) could be another option, but in order to use IV, the structure of the model has to be decided beforehand. SEM allows the

examination of complex structured models more flexible. Below is the equations used for the estimation:

$$Y_{ij} = \beta_0 + \beta_1 S_{0j} + \beta_2 P_{ij} + \beta_3 A_{ij} + \beta_4 EA_{ij} + \beta_5 X_{1,ij} + \beta_6 Z_{1,0j} + \varepsilon_{ij} \quad (1)$$

$$P_{ij} = \theta_0 + \theta_1 X_{2,ij} + \tau_{ij} \quad (2)$$

$$A_{ij} = \gamma_0 + \gamma_1 P_{ij} + \gamma_2 X_{3,ij} + \gamma_3 Z_{2,0j} + u_{ij} \quad (3)$$

$$EA^*_{ij} = \delta_0 + \delta_1 P_{ij} + \delta_2 X_{4,ij} + \delta_3 Z_{3,0j} + \epsilon_{ij} \quad (4)$$

$$EA_{ij} \begin{cases} 1 \; if \; EA^*_{ij} \leq \mu_1 \\ 2 \; if \; \mu_1 < EA^*_{ij} \leq \mu_2 \\ 3 \; if \; \mu_2 < EA^*_{ij} \leq \mu_3 \\ 4 \; if \; \mu_3 < EA^*_{ij} \end{cases}$$

Where:

Y_{ij} = mathematics and science achievement of student *i* in school *j*

$\beta_{0j}, \theta_0, \gamma_0$ and δ_0 = intercept

S_{0j} = latent variable (random intercept) of school which varies at the school level, which is consistent within school

P_{ij} = parental involvement

A_{ij} = adolescents' attitudes towards mathematics and science

EA^*_{ij} = latent variable of adolescents' educational aspiration, whose values determine what the observed ordinal variable EA_{ij} equals

EA_{ij} = adolescents' educational aspiration (only for eighth grade)

$X_{1,ij}$ = vector of the student level control variables for Eq. (1)

$X_{2,ij}$ = vector of the student level control variables for Eq. (2)

$X_{3,ij}$ = vector of the student level control variables for Eq. (3)

$X_{4,ij}$ = vector of the student level control variables for Eq. (4)

$Z_{1,0j}$ = vector of the school level control variables for Eq. (1)

$Z_{2,0j}$ = vector of the school level control variables for Eq. (3)

$Z_{3,0j}$ = vector of the school level control variables for Eq. (4)

$\varepsilon_{ij}, \tau_{ij}, u_{ij},$ and ϵ_{ij} = residual term

The direct and indirect effects are all examined in a single model (Figure 2.2) by using Eq. (1), (2) and (3) for fourth grade and by using Eq. (1), (2), (3) and (4) for eighth grade.[1] β_1 is automatically constrained to be 1. Such constraints are automatically supplied by Stata 14 to identify the latent variable. The final models were decided among converged models based on Akaike Information Criterion (AIC) (Akaike, 1987). The AIC measure is used to compare models with different numbers of latent variables. It aims to identify those models that represent a good compromise between model fit and model complexity and selects most relevant variables to prevent overfitting (Garamszegi and Mundry, 2014; Sauerbrei et al., 2007). Lower values for AIC indicate a better model fit. Therefore, some control variables that are not important are dropped from the model based on the AIC. The results did not change significantly from the models that use all the variables (see Appendix A from Table A.2 to A.10 for the detailed results). Each value of AIC for the final models are as follows: Model 1(71668), Model 2 (71686), Model 3 (72815), Model 4 (72826), Model 5 (70166), Model 6 (70176), Model 7 (71672), Model 8 (71696), Model 9 (164053), Model 10 (169972), Model 11 (142262), Model12 (142348), Model 13 (139422), Model 14 (139405), Model 15 (164742), and Model 16 (171096)[2].

[1] Estimation of similar models are also conducted and the results are consistent with the final one.

[2] Models 1 to 8 estimate fourth graders and models 9 to 16 estimate eighth graders. Models 1 to 4 and 9 to 12 estimate for mathematics. Model 5 to 8 and 13 to 16 estimate for science. Odd number models use the four types of involvement (*Ask*, *Talk*, *Time* and *Check*) and even number models use the aggregated parental involvement (*Communicating* and *Monitoring*). Model 1, 2, 5, 6, 9, 10, 13, and 14 estimate males and the 3, 4, 7, 8, 11, 12 estimate females.

2.5.1 Descriptive Statistics

Table 2.1 (for fourth grade) and 2.2 (for eighth grade) provides the weighted descriptive statistics for each grade. It shows that parents of elementary school children are more involved in their children's education. The difference is especially clear for the frequency of checking if their children do their homework: parents of elementary school children do it more frequently than parents of middle school children. Among the four types of involvement, checking homework is the most frequent type of involvement in elementary school. For middle school, talking about schoolwork is the most frequent type of involvement. Descriptive statistics show that parents change types of involvement according to their children's school level. Also, parents ask about what their children learned in school and about school work more frequently to female than to males. As for mathematics and science achievement, means of male students' achievements are higher than female's in both elementary and middle school.

2.6 Results

Results are discussed at 5% significant level.

Fourth Grade

The results for mathematics achievement are illustrated in Figure 2.3 for male students and Figure 2.4 for females (the detailed results are shown in Table 2.4). The results for science achievement are illustrated in Figure 2.5 for males and Figure 2.6 for females (the detailed results are shown in Table 2.5). Results show that parental involvement is associated with mathematics and science achievement directly and also indirectly through attitude for both males and females. Also, the associations are partly different between males, females and the subjects.

Largely, *Communicating* type of involvement such as *Talk* and *Ask* influence attitude positively. That is when more parents ask children about what they learned in school and talk about their schoolwork, children have more positive attitudes towards the subjects. On the other hand, *Monitoring* type of involvement such as *Check* tends to influence achievement directly. That is children gain higher achievement when their parents check their homework more. Some of these types also influence attitude. *Time* is positively associated with mathematics and science attitude of male students. Also, it is positively associated with female students' science achievement. In addition to this, *Check* is positively associated with female students' science attitude and *Monitoring* is associated with science achievement for both males and females. However, negative associations are also found. *Communicating* and *Talk* are negatively associated with achievement except for female students' mathematics achievement (model 3) (see Figure 2.4).

As for the control variables, some differences are found especially between males and females. Measures of socioeconomic status are largely associated with achievement and attitudes. Number of possessions at home is positively associated with achievement and attitudes except to science attitudes of females. Number of books at home is positively associated with achievement and female students' attitude. It may indicate that females benefit more from books. As for other control variables, children born between January 1 and April 1 are negatively associated with achievement. However, it is positively associated with male students' science attitudes. Experience of being bullied is negatively associated with female students' attitudes and male students' mathematics attitudes. Total enrolment of students is positively associated with male students' attitudes. Location of school is positively associated with mathematics achievement. That is when school is located in a bigger city, students get higher achievement. Income level of school area is positively associated with achievement and male students' science attitudes. Interestingly, larger class size is negatively associated with

male students' attitudes, however it is positively associated with female students' mathematics achievement.

Eighth Grade

The results for mathematics achievement are illustrated in Figure 2.7 for males and Figure 2.8 for females (the detailed results are shown in Table 2.6 for males and Table 2.7 for females). Also, the results for science achievement are illustrated in Figure 2.9 for males and Figure 2.10 for females (the detailed results are shown in Table 2.8 for males and Table 2.9 for females). Results show that parental involvement is indirectly associated with mathematics and science achievement through attitude and aspiration for both males and females. Also, the associations are partly different between males, females and the subjects.

Talk and *Communicating* are positively and significantly associated with attitude. That is when more parents ask children about what they learned in school and talk about their schoolwork, children have more positive attitudes towards the subjects. *Talk* and *Communicating* are also positively associated with aspiration except that *Talk* is not significantly associated for females. *Monitoring* and *Check* are positively associated with male students' mathematics attitude and female students' science attitudes. However, negative associations are also found. *Monitoring* is negatively associated with male students' mathematics achievement and *Check* is negatively associated with female students' mathematics achievement.

As for the control variables, associations are largely similar between gender and subjects. Socioeconomic measures are associated with achievement, attitude and aspiration. Number of possessions at home is positively and significantly associated with achievements, attitudes and aspiration except for male students' achievement and female students' science attitude. Number of books at home is positively associated with achievements and aspiration. Also, it is

positively associated with science attitudes. As for educational level of parents, largely, parents graduated higher than university is positively associated with aspiration. However, fathers graduated junior college is negatively associated with aspiration and mathematics achievement. Mothers graduated junior college is differently associated with males and females: it is positively associated with male students' achievement whereas negatively associated with female students' aspiration. Children born between January 1 and April 1 are negatively associated with male students' achievement. Attending private or national school is positively associated with aspiration and males students' mathematics achievement and attitudes. *School-P* is positively associated with male students' achievement. That is male students gain higher achievement when the average of the level of schooling of the parents whose children study in the same school is higher. Higher income level is positively associated with female students' aspiration. Experience of being bullied and class size is not significantly associated even though there are some associations in fourth grade.

2.7 Discussion

This study investigated the effects of home-based parental involvement on academic achievement and how the association differs across three criteria: elementary and middle school (school level), male and female (gender), and math and science (subject). Also, it examined how students' attitudes and educational aspiration mediate the relationships between parental involvement and achievement. Results show that students' attitude towards subjects and academic aspiration mediate the associations between home-based parental involvement and academic achievement for both elementary and middle school. Also, the associations between parental involvement and academic achievement vary according to the school level, gender, and subjects even though both male and female students benefit from parental involvement.

How monitoring types of involvements (*Time*, *Check* and *Monitoring*) are associated with the achievements differ between elementary and middle school. In elementary school, it influences the achievements both directly and indirectly through the attitudes. On the other hand, in middle school, it mainly influences the achievements indirectly through the attitudes and the aspiration.

It may be attributed the fact that the fourth and eighth graders are at different developmental stages. Studies show that the levels of understanding of the purpose of doing homework are different depending on children's developmental stages (Warton, 1997; Xu, 2005). For example, Warton (1997) reported that when grades 2, 4 and 6 are asked whether it matters if someone else does all their homework, they generally agreed that they should complete their own homework. However, their understanding of responsibility was not clear among younger students. More grade 6 children than younger children gave an internal justification such as they will not learn if someone else does their homework. Although some younger children answered the same, they are also likely to give an external justification such as the teacher would not like it if someone else does their homework. This indicates that younger children have not completely developed an understanding of the purpose of doing homework.

It is likely that children in elementary and middle school may perceive parental monitoring of their homework differently because of the different levels of understanding regarding the very purpose of doing homework. Since older students are more likely to understand the meaning of doing homework diligently, they might perceive the importance of education through their parents' monitoring activities, which in turn, enhances their attitudes. On the other hand, since younger children are less likely to have the same kind of understanding, monitoring will also influence achievement directly. In other words, they would write their homework because of external reasons such as to please their teachers and/or avoid parental reprehension, which would result in higher achievement without improving their attitudes.

Finally, as hypothesised, the effects of monitoring on achievement and attitudes are more significant among elementary than middle school students, which suggests that elementary students reap more benefits more from it.

Overall, as for the patterns of the effects of parental involvement, more similarities are found between gender and the subject even though some differences are also found. As for the differences, in fourth grade, monitoring types of involvement are more associated with attitudes in science compared to mathematics. Also, females benefit slightly more from parental monitoring than males and males benefit slightly more from parental communicating than females. In eighth grade, *Check* and *Monitoring* are associated with mathematics attitudes for males, but not for females and science attitudes for females, but not for males. Also, *Talk* is associated with male students' aspiration but not females. Most of these differences are difficult to interpret. However, contrary to what was hypothesised, it shows that communicating types of involvement are more significantly associated with males than females.

Some negative associations are also found only in the direct relationships between parental involvement and achievement. *Talk* and *Communicating* are negatively associated with achievement in elementary school. Among middle school students, *Check* is negatively associated with female mathematics achievement. *Monitoring* is negatively associated with male mathematics achievement. Negative association between monitoring and mathematics achievement is consistent with previous studies (Zhan, 2006; Sui-Chu and Willms, 1996). Negative associations between parental involvement and academic achievement are also found in other previous studies (Lee and Bowen, 2006; Shumow and Miller, 2001; Milne et al., 1986) For example, Milne et al. (1986) found that parental homework help is negatively associated with achievement and suggested that parent provide help when their children are not doing well academically. The negative associations found in this study can be explained in the same

way. It is likely that the parents tend to communicate or monitor their children more when their children are not doing well academically.

The results of the study suggest the importance of taking into account school level, indirect effects of parental involvement, types of involvement, and students' gender to understand how parental involvement influences academic achievement. Therefore, investigating parental involvement without considering these factors may fail to capture the true mechanism of parental involvement. Also, the present study examines only the effects of parental discussion and monitoring. Further studies need to investigate the effects of other types of involvement on achievement for a better understanding of its mechanisms.

Limitation

Because of lack of data, the present study is unable to control the education level of parents of fourth grade students. For the same reason, this study could not examine subjects other than mathematics and science. Different associations might be found when other subjects, such as English, are investigated and compared with the results of mathematics and science. Also, different patterns of gender differences might be found in different subjects. Therefore, further studies using data that includes other subjects are recommended.

Additionally, concerning the explanation for the negative association of parental involvement, it is not possible to analyse whether a problem of inverse causal relationship explained in the previous section applies to this case since cross-section data is used in the study. Likewise, even though it is also possible that parents get involved more when their children are good at mathematics and science and have higher educational aspiration, it was impossible to analyse such causality in this study because the data used in the present study does not include information of previous grades and achievements. Further study using panel data is needed in order to test the causal relationships.

2.8 Conclusion

This study investigated the effects of home-based parental involvement on academic achievement and how students' attitudes and educational aspiration mediate the relationships between parental involvement and mathematics and science achievement. Samples of elementary and middle school children were analysed separately and according to gender and two different subjects (mathematics and science). The analyses were conducted by using a weighted generalised multilevel structural equation model. The results showed that students' attitude and aspiration mediate the associations between home-based parental involvement and academic achievement at both elementary and middle school. Also, the associations between parental involvement and academic achievement vary according to the school level, gender, and the subjects. The notable difference is found between elementary and middle school: in the former, monitoring types of involvement (parents making sure children set aside time for their homework and checking homework) influence academic achievements both directly and indirectly (through enhancing attitudes towards subjects). In the latter, they influence achievement mainly indirectly. Also, the effects of monitoring on achievement and attitudes are more significant among elementary than middle school students, which suggests that elementary students reap more benefits more from it. The results of the study suggest the importance of taking into account school level, indirect effects of parental involvement, types of involvement, and students' gender to understand how parental involvement influences academic achievement. Also, given the findings that the parental involvement, parental communicating and monitoring, influence both elementary and middle school students' educational outcome positively, schools and policy makers may need to develop policies to encourage parental involvement.

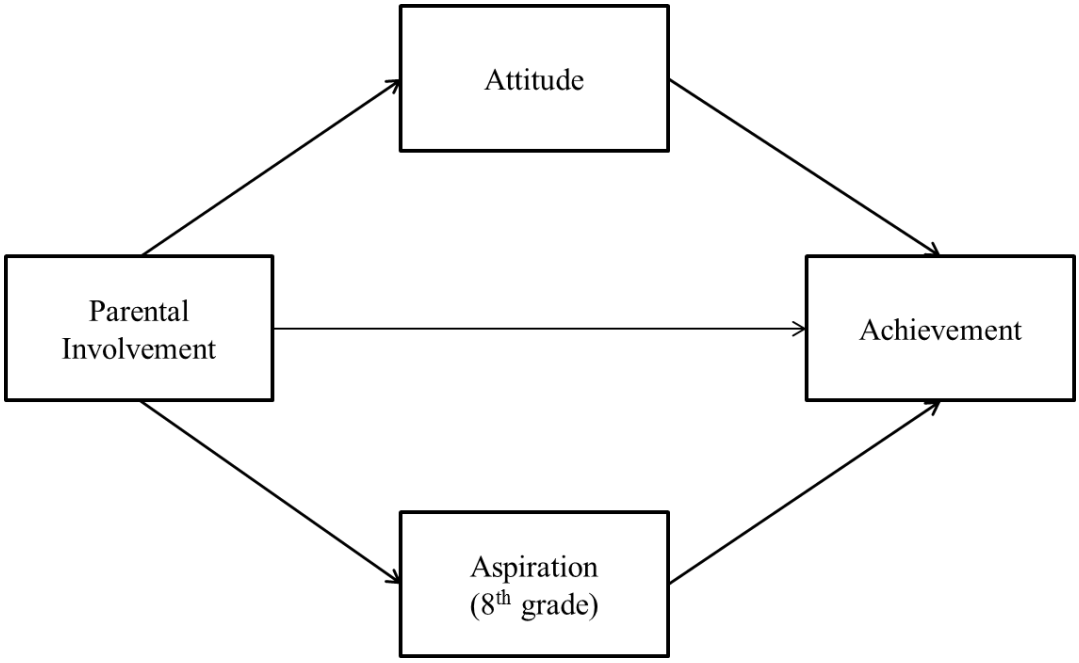


Figure 2.1 Hypothesised Model

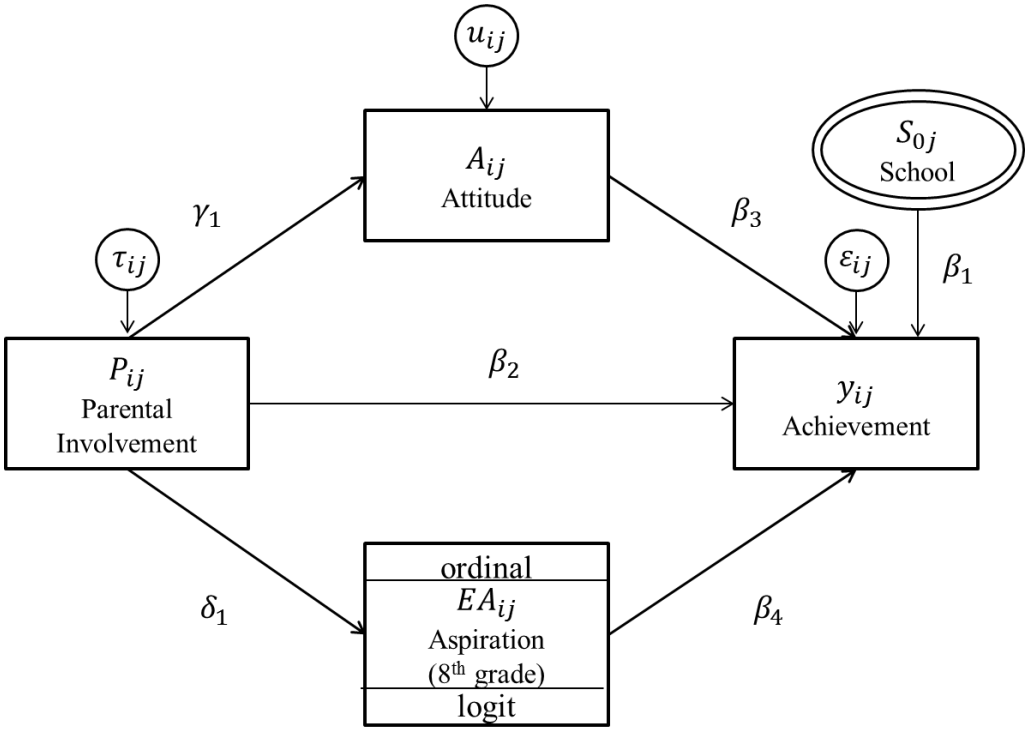


Figure 2.2 Model of the Effects of Parental Involvement on Adolescents' Educational Outcome

Control variables are omitted from the figure to facilitate visualization

Model 1 Model 2

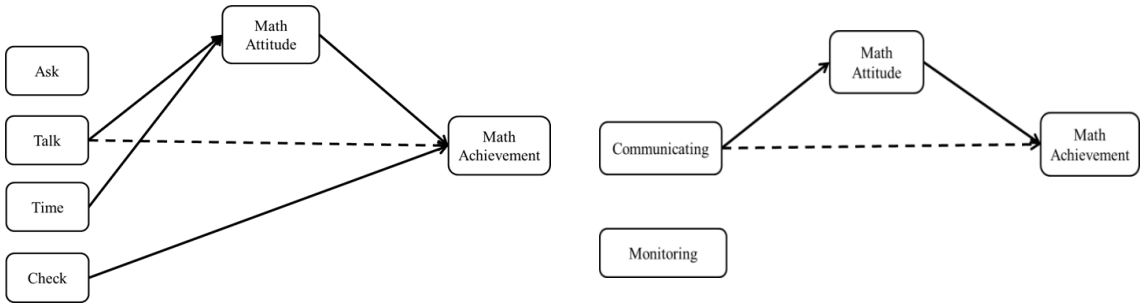


Figure 2.3 Model 1 and 2

SEM depicting mediation effects of academic attitude between parental involvement and mathematics achievement for fourth grade male students. Solid lines represent positive effects and dotted lines represent negative effects. Only significant paths ($p<.05$) are shown.

Model 3 Model 4

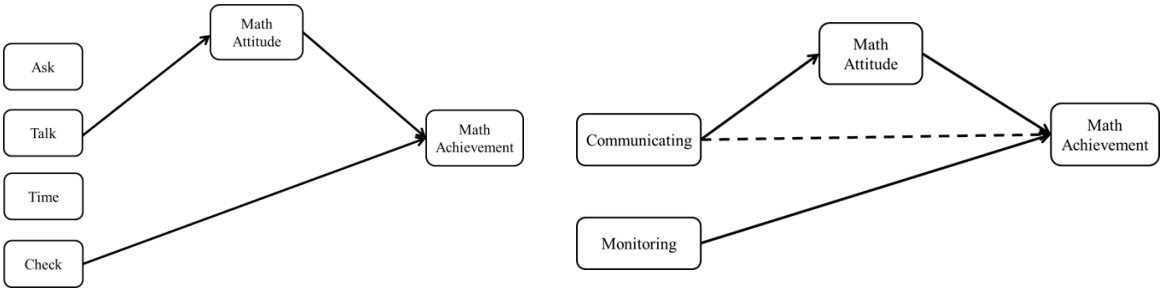


Figure 2.4 Model 3 and 4

SEM depicting mediation effects of academic attitude between parental involvement and mathematics achievement for fourth grade female students. Solid lines represent positive effects and dotted lines represent negative effects. Only significant paths ($p<.05$) are shown.

Model 5 Model 6

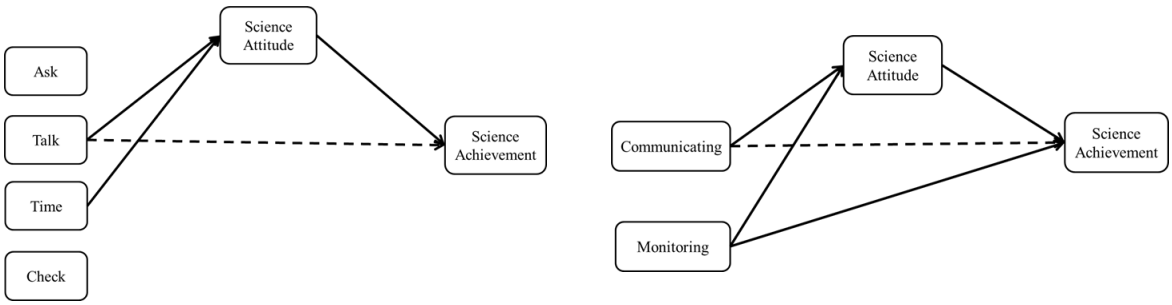


Figure 2.5 Model 5 and 6
SEM depicting mediation effects of academic attitude between parental involvement and science achievement for fourth grade male students. Solid lines represent positive effects and dotted lines represent negative effects. Only significant paths ($p<.05$) are shown.

Model 7 Model 8

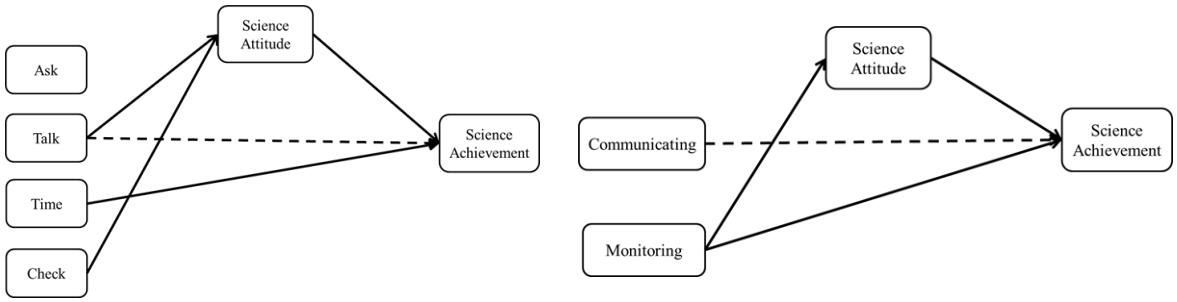
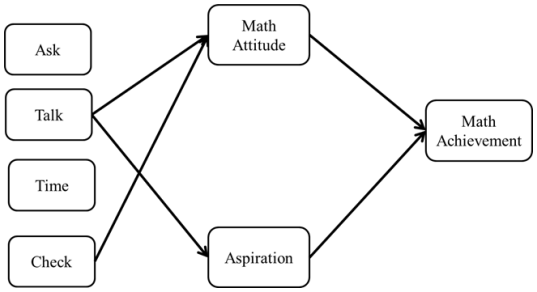


Figure 2.6 Model 7 and 8
SEM depicting mediation effects of academic attitude between parental involvement and science achievement for fourth grade female students. Solid lines represent positive effects and dotted lines represent negative effects. Only significant paths ($p<.05$) are shown.

Model 9



Model 10

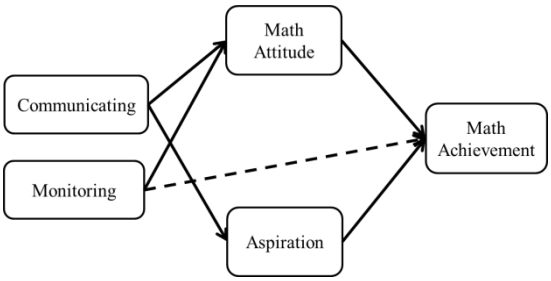
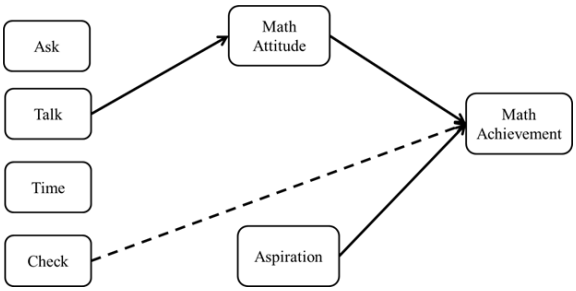


Figure 2.7 Model 9 and 10

SEM depicting mediation effects of academic attitude and aspiration between parental involvement and mathematics achievement for eighth grade male students. Solid lines represent positive effects and dotted lines represent negative effects. Only significant paths ($p<.05$) are shown.

Model11



Model 12

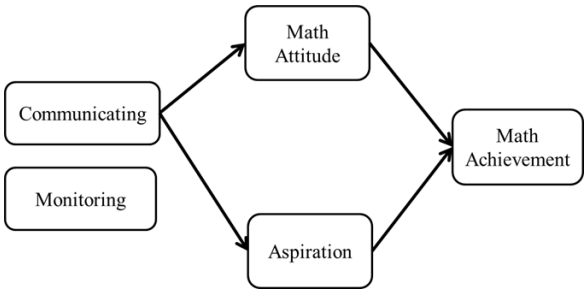
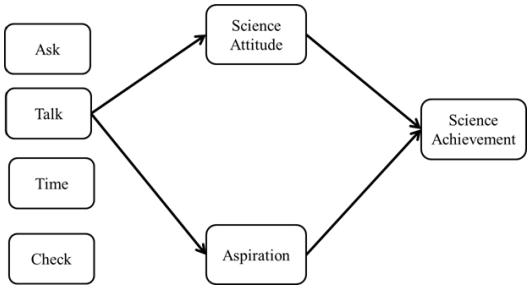


Figure 2.8 Model 11 and 12

SEM depicting mediation effects of academic attitude and aspiration between parental involvement and mathematics achievement for eighth grade female students. Solid lines represent positive effects and dotted lines represent negative effects. Only significant paths ($p<.05$) are shown.

Model 13



Model 14

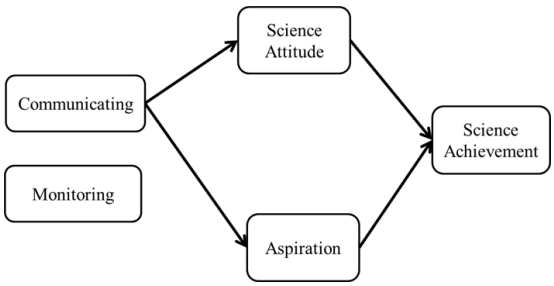
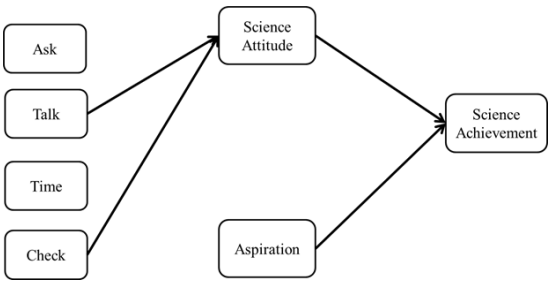


Figure 2.9 Model 13 and 14
SEM depicting mediation effects of academic attitude and aspiration between parental involvement and science achievement for eighth grade male students. Solid lines represent positive effects and dotted lines represent negative effects. Only significant paths ($p<.05$) are shown.

Model 15



Model 16

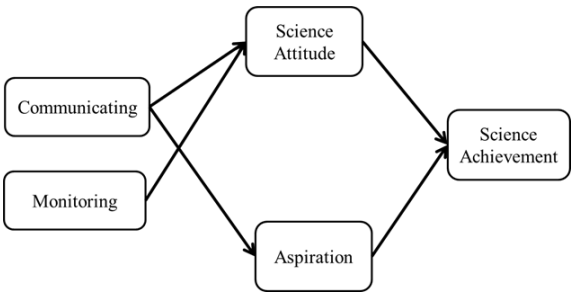


Figure 2.10 Model 15 and 16
SEM depicting mediation effects of academic attitude and aspiration between parental involvement and science achievement for eighth grade female students. Solid lines represent positive effects and dotted lines represent negative effects. Only significant paths ($p<.05$) are shown.

Table 2.1 Weighted Descriptive Statistics for Fourth Grade

(Female: N= 1,884 students and 140 schools, Male: N= 1,849 students and 139 schools)

	Female				Male			
Variable	Mean or %	Std. Dev.	Min	Max	Mean or %	Std. Dev.	Min	Max
Mathematics achievement	586.63	64.32	349.93	770.85	592.14	68.79	330.10	752.99
Science achievement	557.76	55.45	345.58	725.99	565.86	60.12	330.32	724.71
Parental involvement								
(Ask)Parents ask a student what you learned in school	2.67	1.01	1	4	2.52	1.05	1	4
(Talk)A student talks about schoolwork with parents	2.93	0.99	1	4	2.70	1.03	1	4
(Time)Parents make sure that a student set aside time for homework	2.25	1.26	1	4	2.23	1.25	1	4
(Check)Parents check if a student does homework	2.97	1.19	1	4	3.03	1.16	1	4
Attitudes toward mathematics								
How much do you agree that...								
you enjoy learning mathematics?	2.84	0.86	1	4	3.06	0.91	1	4
you wish you did not have to study mathematics?*	3.29	0.77	1	4	3.32	0.84	1	4
mathematics is boring?*	3.11	0.83	1	4	3.18	0.86	1	4
you learn many interesting things in mathematics?	2.88	0.84	1	4	3.02	0.88	1	4
you like mathematics?	2.69	0.99	1	4	3.01	0.98	1	4
it is important to do well in mathematics?	3.43	0.73	1	4	3.37	0.82	1	4
Attitudes toward science								
How much do you agree that...								
you enjoy learning science?	3.34	0.75	1	4	3.55	0.70	1	4
you wish you did not have to study science?*	3.48	0.68	1	4	3.53	0.72	1	4
you read about science in your spare time?	1.97	0.86	1	4	2.19	0.96	1	4
science is boring?*	3.42	0.71	1	4	3.45	0.77	1	4
you learn many interesting things in science?	3.28	0.81	1	4	3.40	0.82	1	4
you like science?	3.19	0.89	1	4	3.42	0.81	1	4
it is important to do well in science?	3.32	0.78	1	4	3.28	0.86	1	4
Number of books at home	2.73	1.04	1	5	2.79	1.09	1	5
Possessions at home (a computer, a desk etc.)	7.88	1.80	1	11	8.04	1.80	2	11
Possessions at home11	0.05		0	1	0.07		0	1
Children born between January 1 to April 1	0.25		0	1	0.23		0	1
Experiences of being bullied								
During this year, how often …								
were you made fun of or called names at school?	2.20	1.10	1	4	2.48	1.12	1	4
were you left out of games or activities by other students at school?	1.63	0.89	1	4	1.74	0.96	1	4
did someone spread lies about you at school?	1.54	0.85	1	4	1.83	1.02	1	4
was something stolen from you at school?	1.37	0.72	1	4	1.49	0.84	1	4
were you hit or hurt by other student(s) at school?	1.61	0.92	1	4	2.00	1.09	1	4
were you made to do things you didn't want to do by other students at school?	1.41	0.75	1	4	1.55	0.88	1	4
Total enrolment of students (in hundreds)	4.17	2.27	0.17	11.1	4.00	2.30	0.17	11.1
Location	2.28	0.94	1	5	2.30	1.00	1	5
Percentage of students from economically disadvantaged home	1.61	0.73	1	4	1.62	0.71	1	4
Income level of school's immediate area	1.89	0.46	1	3	1.89	0.46	1	3
Class size	27.54	6.79	4	39	27.22	6.77	7	39

Note: *Answer categories are inversed

Table 2.2 Weighted Descriptive Statistics for Eighth Grade

(Female: N= 1,812 students and 133 schools, Male: N= 1,789 students and 131 schools)

	Female				Male			
Variable	Mean or %	Std. Dev.	Min	Max	Mean or %	Std. Dev.	Min	Max
Mathematics achievement	568.79	76.89	307	820	575.50	83.08	162	828
Science achievement	555.19	67.83	329	751	564.73	73.98	143	795
Parental involvement								
(Ask)Parents ask a student what you learned in school	2.38	0.98	1	4	2.29	0.97	1	4
(Talk)A student talks about schoolwork with parents	2.68	0.94	1	4	2.39	0.96	1	4
(Time)Parents make sure that a student set aside time for homework	2.00	1.11	1	4	1.97	1.10	1	4
(Check)Parents check if a student does homework	2.13	1.16	1	4	2.16	1.15	1	4
Academic aspiration	5.70	1.54	0	9	5.72	1.89	0	9
Attitudes toward mathematics								
How much do you agree that...								
you enjoy learning mathematics?	2.34	0.86	1	4	2.63	0.92	1	4
you wish you did not have to study mathematics?*	2.57	0.88	1	4	2.86	0.91	1	4
mathematics is boring?*	2.52	0.81	1	4	2.74	0.89	1	4
you learn many interesting things in mathematics?	2.20	0.77	1	4	2.45	0.87	1	4
you like mathematics?	2.17	0.91	1	4	2.48	0.98	1	4
it is important to do well in mathematics?	3.24	0.75	1	4	3.32	0.79	1	4
Attitudes toward science								
How much do you agree that...								
you enjoy learning science?	2.58	0.84	1	4	2.94	0.87	1	4
you wish you did not have to study science?*	2.59	0.87	1	4	2.95	0.87	1	4
you read about science in your spare time?	1.43	0.65	1	4	1.72	0.80	1	4
science is boring?*	2.69	0.83	1	4	2.97	0.84	1	4
you learn many interesting things in science?	2.50	0.88	1	4	2.80	0.89	1	4
you like science?	2.37	0.93	1	4	2.78	0.94	1	4
it is important to do well in science?	2.89	0.88	1	4	3.14	0.85	1	4
Number of books at home	2.91	1.22	1	5	3.00	1.27	1	5
Possessions at home (a computer, a desk etc.)	7.82	1.57	1	11	7.83	1.72	2	11
Possessions at home11	0.03		0	1	0.05		0	1
Highest level of education completed by mother								
University, college, or Graduate school	0.45		0	1	0.38		0	1
Junior college	0.27		0	1	0.20		0	1
High school or below	0.37		0	1	0.35		0	1
Unknown	0.19		0	1	0.27		0	1
Highest level of education completed by father								
University, college, or Graduate school	0.39		0	1	0.39		0	1
Junior college	0.08		0	1	0.09		0	1
High school or below	0.32		0	1	0.29		0	1
Unknown	0.29		0	1	0.32		0	1
Children born between January 1 to April 1	0.23		0	1	0.25		0	1
Experiences of being bullied								
During this year, how often …								
were you made fun of or called names at school?	2.04	1.00	1	4	2.34	1.12	1	4
were you left out of games or activities by other students at school?	1.37	0.68	1	4	1.41	0.73	1	4
did someone spread lies about you at school?	1.43	0.71	1	4	1.65	0.87	1	4
was something stolen from you at school?	1.12	0.36	1	4	1.30	0.63	1	4
were you hit or hurt by other student(s) at school?	1.34	0.76	1	4	1.83	1.07	1	4
were you made to do things you didn't want to do by other students at school?	1.27	0.58	1	4	1.39	0.73	1	4
Total enrolment of students (in hundreds)	3.62	2.30	0.45	11.1	3.49	2.25	0.45	10.1
Location	2.33	0.97	1	4	2.23	0.94	1	4
Type of school	0.10		0	1	0.09		0	1
School-P	7.55	0.77	6.33	9.42	7.49	0.72	6.33	9.42
Income level of school's immediate area	1.85	0.58	1	3	1.80	0.57	1	3
Percentage of students from economically disadvantaged home	1.82	0.85	1	4	1.87	0.91	1	4
Class size	30.16	5.60	16	46	29.90	5.55	16	46

Note: *Answer categories are inversed

Table 2.3 Results for Factor Analysis

	Fourth grade		Eighth grade	
	Male	Female	Male	Female
	Factor1	Factor1	Factor1	Factor1
Attitudes toward Math				
How much do you agree that...				
you enjoy learning mathematics?	0.921	0.896	0.877	0.886
you wish you did not have to study mathematics?*	0.572	0.601	0.526	0.569
mathematics is boring?*	0.659	0.676	0.650	0.717
you learn many interesting things in mathematics?	0.707	0.687	0.789	0.750
you like mathematics?	0.907	0.901	0.907	0.876
it is important to do well in mathematics?	0.389	0.389	0.339	0.289
Attitudes toward Science				
How much do you agree that...				
you enjoy learning science?	0.843	0.872	0.881	0.874
you wish you did not have to study science?*	0.628	0.645	0.594	0.662
you read about science in your spare time?	0.428	0.402	0.477	0.453
science is boring?*	0.666	0.699	0.717	0.714
you learn many interesting things in science?	0.726	0.682	0.812	0.744
you like science?	0.882	0.892	0.901	0.874
it is important to do well in science?	0.529	0.432	0.470	0.396
Experiences of being bullied				
During this year, how often …				
were you made fun of or called names at school?	0.699	0.685	0.697	0.728
were you left out of games or activities by other students at school?	0.680	0.682	0.663	0.679
did someone spread lies about you at school?	0.671	0.643	0.670	0.642
was something stolen from you at school?	0.524	0.509	0.428	0.353
were you hit or hurt by other student(s) at school?	0.637	0.569	0.714	0.545
were you made to do things you didn't want to do by other students at school?	0.620	0.639	0.676	0.592

*Answer categories are inversed

Table 2.4 Results for Fourth Grade (Mathematics)

VARIABLES	Male				Female			
	Model 1		Model 2		Model 3		Model 4	
	Achievement	Attitude	Achievement	Attitude	Achievement	Attitude	Achievement	Attitude
Ask	-0.0447	0.0364			-2.771	0.0525*		
	(1.583)	(0.028)			(1.751)	(0.029)		
Talk	-4.801***	0.0871***			-3.450*	0.129***		
	(1.721)	(0.028)			(1.795)	(0.028)		
Time	-0.244	0.0436**			1.348	0.0356*		
	(1.358)	(0.021)			(1.379)	(0.020)		
Check	2.813**	-0.00816			3.100**	-0.0134		
	(1.398)	(0.021)			(1.388)	(0.021)		
Communicating			-3.665***	0.0924***			-4.620***	0.135***
			(1.192)	(0.021)			(1.318)	(0.023)
Monitoring			2.231*	0.0303*			3.835***	0.0182
			(1.287)	(0.018)			(1.297)	(0.020)
Mathematics attitude	20.15***		20.04***		17.82***		17.77***	
	(1.658)		(1.660)		(1.736)		(1.730)	
Possessions at home	4.049***	0.0574***	4.033***	0.0580***	3.697***	0.0508***	3.302***	0.0516***
	(1.174)	(0.015)	(1.176)	(0.015)	(0.994)	(0.015)	(0.919)	(0.015)
Possessions at home11	-15.29**		-15.49**		-7.295	-0.118		-0.119
	(6.148)		(6.112)		(5.754)	(0.109)		(0.111)
Number of books at home	14.21***	0.0308	14.28***	0.0299	13.79***	0.0786***	13.69***	0.0811***
	(1.607)	(0.026)	(1.626)	(0.026)	(1.746)	(0.026)	(1.733)	(0.026)
Children born between January 1 and April 1	-16.34***	0.0877*	-16.34***	0.0879*	-16.04***		-16.00***	
	(3.550)	(0.052)	(3.531)	(0.053)	(3.318)		(3.320)	
Experiences of being bullied		-0.0673***		-0.0700***		-0.149***		-0.149***
		(0.023)		(0.023)		(0.029)		(0.030)
Total enrolment of students (in hundreds)		0.0366**		0.0372**		-0.00837		
		(0.015)		(0.015)		(0.014)		
Location of school	4.491**	-0.0695*	5.121***	-0.0704*	3.780**		3.901**	
	(1.814)	(0.036)	(1.927)	(0.037)	(1.756)		(1.754)	
Income level of school area	16.33***	-0.115*	14.47***	-0.114	10.19***		10.22***	
	(3.305)	(0.069)	(3.455)	(0.069)	(3.304)		(3.291)	
Class size		-0.0183***		-0.0184***	0.629**		0.637**	
		(0.006)		(0.006)	(0.314)		(0.316)	
% of economically disadvantaged students		-0.0712	-2.491	-0.0710		-0.0730*		
		(0.057)	(2.847)	(0.058)		(0.039)		
Random intercept of school	1		1		1		1	
	(0)		(0)		(0)		(0)	
Constant	484.8***	0.00854	485.2***	0.415	484.3***	-1.145***	482.1***	-0.787***
	(13.090)	(0.297)	(13.310)	(0.313)	(14.420)	(0.144)	(12.970)	(0.138)
Observations	1849	1849	1849	1849	1884	1884	1884	1884

Robust standard errors in parentheses

Note: AIC for Model 1 = 71668, Model 2 = 71686, Model 3 = 72815, and Model 4 =72826.

Table 2.5 Results for Fourth Grade (Science)

VARIABLES	Male				Female			
	Model 5		Model 6		Model 7		Model 8	
	Achievement	Attitude	Achievement	Attitude	Achievement	Attitude	Achievement	Attitude
Ask	0.442	-0.00300			-0.545	-0.0332		
	(1.458)	(0.026)			(1.471)	(0.026)		
Talk	-3.904***	0.0631**			-3.800***	0.0886***		
	(1.507)	(0.027)			(1.457)	(0.025)		
Time	1.642	0.0525**			2.652**	0.0167		
	(1.148)	(0.022)			(1.163)	(0.020)		
Check	0.988	0.0295			0.889	0.0419**		
	(1.205)	(0.021)			(1.255)	(0.021)		
Communicating			-2.444**	0.0448**			-3.105***	0.0394*
			(1.087)	(0.020)			(1.100)	(0.022)
Monitoring			2.321**	0.0700***			3.087***	0.0490**
			(1.153)	(0.020)			(1.194)	(0.020)
Science attitude	6.105***		6.037***		7.266***		7.142***	
	(1.271)		(1.290)		(1.288)		(1.307)	
Possessions at home	3.422***	0.0479***	3.437***	0.0479***	2.875***	0.0265*	2.950***	0.0241*
	(0.980)	(0.016)	(0.983)	(0.016)	(0.851)	(0.014)	(0.836)	(0.014)
Possessions at home11	-13.67**	-0.0927	-13.68**	-0.0910		0.197**		0.203**
	(5.713)	(0.099)	(5.643)	(0.099)		(0.091)		(0.091)
Number of books at home	14.96***	0.0442*	14.95***	0.0433*	13.59***	0.0606***	13.60***	0.0614***
	(1.442)	(0.024)	(1.443)	(0.024)	(1.418)	(0.020)	(1.418)	(0.020)
Children born between January 1 and April 1	-22.30***	0.112**	-22.35***	0.113**	-21.53***	0.0673	-21.51***	0.0657
	(3.007)	(0.051)	(3.007)	(0.051)	(2.732)	(0.052)	(2.730)	(0.052)
Experiences of being bullied		-0.0215		-0.0238		-0.0801**		-0.0804**
		(0.023)		(0.023)		(0.033)		(0.032)
Total enrolment of students (in hundreds)		0.0302**		0.0305**		0.0197		0.0209
		(0.014)		(0.014)		(0.017)		(0.017)
Location of school			2.695					
			(1.647)					
Income level of school area	11.26***	-0.155***	10.72***	-0.155***	8.579***	-0.123	8.015***	-0.119
	(3.160)	(0.054)	(3.083)	(0.054)	(3.119)	(0.081)	(3.097)	(0.081)
Class size		-0.0146**		-0.0147**			0.444*	
		(0.006)		(0.006)			(0.259)	
% of economically disadvantaged students		-0.0976*		-0.0972*		-0.0440		-0.0405
		(0.057)		(0.057)		(0.044)		(0.044)
Random intercept of school	1		1		1		1	
	(0)		(0)		(0)		(0)	
Constant	483.3***	-0.0550	474.6***	0.321	491.5***	-0.640***	475.6***	-0.315
	(9.964)	(0.284)	(10.230)	(0.275)	(8.009)	(0.243)	(9.686)	(0.236)
Observations	1849	1849	1849	1849	1884	1884	1884	1884

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 5 = 70166, Model 6 = 70176, Model 7 = 71672, and Model 8 =71696.

Table 2.6 Results for Eighth Grade (Male: Mathematics)

	Male							
	Model 9				Model 10			
VARIABLES	Achievement	Attitude	Aspiration	Ask	Achievement	Attitude	Aspiration	Communicating
Ask	2.752	-0.00888	0.110					
	(2.237)	(0.034)	(0.079)					
Talk	0.923	0.105***	0.237***					
	(2.524)	(0.030)	(0.071)					
Time	-1.531	0.0213	0.0750					
	(2.047)	(0.034)	(0.067)					
Check	-1.658	0.0655**	-0.0281					
	(1.812)	(0.030)	(0.074)					
Communicating					2.560	0.0655***	0.237***	
					(1.655)	(0.020)	(0.048)	
Monitoring					-2.675**	0.0710***	0.0408	
					(1.350)	(0.023)	(0.050)	
Mathematics attitude	24.97***				25.10***			
	(1.658)				(1.696)			
Aspiration	31.67***				31.83***			
	(2.190)				(2.185)			
Possessions at home	1.804	0.0920***	0.258***	0.254***	1.839	0.0903***	0.259***	0.172***
	(1.287)	(0.014)	(0.035)	(0.026)	(1.272)	(0.014)	(0.035)	(0.018)
Possessions at home11								
Number of books at home	6.414***		0.139***		6.402***		0.139***	
	(1.496)		(0.047)		(1.488)		(0.047)	
Ref: High school or below								
Mother: Higher than University			0.711***				0.687***	
			(0.217)				(0.216)	
Mother: Junior college	10.05**	0.0610	-0.255		10.04**	0.0609	-0.253	
	(4.511)	(0.055)	(0.215)		(4.528)	(0.055)	(0.215)	
Mother: Unknown	-8.589*		0.271		-8.559*		0.261	
	(4.775)		(0.165)		(4.795)		(0.167)	
Father: Higher than University		0.168***	1.129***			0.167***	1.143***	
		(0.064)	(0.182)			(0.065)	(0.184)	
Father: Junior college	-17.38***	-0.102	-0.758***		-17.42***	-0.106	-0.766***	
	(6.657)	(0.091)	(0.220)		(6.576)	(0.090)	(0.218)	
Father: Unknown	-5.145	0.109*	0.328*		-5.268	0.110*	0.334*	
	(4.519)	(0.060)	(0.175)		(4.523)	(0.060)	(0.179)	
Children born between January 1 and April 1	-13.70***				-13.43***		-0.112	
	(4.419)				(4.437)		(0.117)	
Experiences of being bullied		0.0348				0.0361		
		(0.029)				(0.029)		
Total enrolment of students (in hundreds)		-0.0190				-0.0170	-0.0202	
		(0.017)				(0.017)	(0.029)	
Location of school	5.741*	0.0334	0.159*		5.773*		0.170**	
	(3.165)	(0.037)	(0.083)		(3.316)		(0.084)	
Private or national school	36.16***	0.197**	0.896***		33.84***	0.212**	0.854***	
	(12.870)	(0.098)	(0.200)		(11.490)	(0.093)	(0.212)	
School-P	12.03**		0.146		15.09**		0.151	
	(5.382)		(0.107)		(6.346)		(0.108)	
Income level of school area		0.104	0.134		-4.347	0.0990	0.150	
		(0.080)	(0.114)		(5.847)	(0.079)	(0.120)	
% of economically disadvantaged students		0.0373				0.0417		
		(0.056)				(0.057)		
Class size		-0.0106	-0.0201		-0.360	-0.0100	-0.0170	
		(0.007)	(0.013)		(0.662)	(0.007)	(0.013)	
Random intercept of school	1				1			
	(0)				(0)			
Constant	361.9***	-1.188***			360.5***	-0.700**		-1.402***
	(40.780)	(0.368)			(45.910)	(0.345)		(0.144)
Observations	1789	1789	1789	1789	1789	1789	1789	1789

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 9 = 164053 and Model 10 = 169972.

Table 2.7 Results for Eighth Grade (Female: Mathematics)

	Female					
	Model 11			Model 12		
VARIABLES	Achievement	Attitude	Aspiration	Achievement	Attitude	Aspiration
Ask	-3.892*	0.00992	0.0217			
	(2.116)	(0.035)	(0.069)			
Talk	2.127	0.159***	0.134*			
	(2.267)	(0.036)	(0.074)			
Time	2.731	0.00161	0.0830			
	(2.158)	(0.029)	(0.063)			
Check	-4.237**	-0.00145	-0.0987			
	(1.958)	(0.028)	(0.064)			
Communicating				-1.146	0.114***	0.111**
				(1.128)	(0.025)	(0.044)
Monitoring				-1.488	-0.00167	-0.0189
				(1.223)	(0.021)	(0.047)
Mathematics attitude	25.26***			25.42***		
	(1.485)			(1.510)		
Aspiration	29.20***			29.42***		
	(2.213)			(2.249)		
Possessions at home	4.751***	0.0765***	0.237***	4.822***	0.0761***	0.240***
	(1.162)	(0.014)	(0.033)	(1.172)	(0.014)	(0.033)
Possessions at home11			-0.501			-0.504
			(0.398)			(0.396)
Number of books at home	9.558***	0.0398*	0.155***	9.473***	0.0412*	0.151***
	(1.419)	(0.022)	(0.050)	(1.426)	(0.022)	(0.050)
Ref: High school or below						
Mother: Higher than University		0.125*	1.318***		0.137*	1.316***
		(0.069)	(0.229)		(0.073)	(0.228)
Mother: Junior college	5.454	-0.0799	-1.025***	5.415	-0.0862	-1.023***
	(3.761)	(0.077)	(0.219)	(3.791)	(0.077)	(0.217)
Mother: Unknown		0.131*	0.551***		0.152**	0.542***
		(0.068)	(0.193)		(0.076)	(0.192)
Father: Higher than University	14.55***	0.127*	1.109***	13.47***	0.106	1.112***
	(4.053)	(0.072)	(0.155)	(4.469)	(0.085)	(0.155)
Father: Junior college	-18.20***	0.147	-0.706***	-18.08***	0.152	-0.705***
	(5.397)	(0.107)	(0.207)	(5.426)	(0.106)	(0.208)
Father: Unknown			0.258	-2.423	-0.0480	0.255
			(0.174)	(4.141)	(0.078)	(0.172)
Children born between January 1 and April 1	-7.486*		-0.263**	-7.310*		-0.262**
	(3.902)		(0.118)	(3.923)		(0.119)
Experiences of being bullied		-0.0191			-0.0204	
		(0.030)			(0.031)	
Total enrolment of students (in hundreds)	1.519			1.583		
	(1.404)			(1.404)		
Location of school						
Private or national school	8.784		1.576***	8.864		1.573***
	(12.070)		(0.262)	(12.340)		(0.267)
School-P		-0.0653	0.167		-0.0673	0.167
		(0.042)	(0.114)		(0.042)	(0.114)
Income level of school area	14.77***		0.357**	14.42***		0.351**
	(4.829)		(0.141)	(5.066)		(0.143)
% of economically disadvantaged students			0.0869			0.0869
			(0.101)			(0.101)
Class size	0.463	-0.00757	-0.0174	0.454	-0.00800	-0.0174
	(0.847)	(0.008)	(0.016)	(0.854)	(0.008)	(0.016)
Random intercept of school	1			1		
	(0)			(0)		
Constant	382.9***	-0.546*		376.8***	-0.0750	
	(29.560)	(0.316)		(29.460)	(0.289)	
Observations	1812	1812	1812	1812	1812	1812

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 11 =142262 and Model12=142348.

Table 2.8 Results for Eighth Grade (Male: Science)

	Male					
	Model 13			Model 14		
VARIABLES	Achievement	Attitude	Aspiration	Achievement	Attitude	Aspiration
Ask	1.052	0.0115	0.108			
	(2.255)	(0.033)	(0.079)			
Talk	-0.335	0.127***	0.233***			
	(2.171)	(0.034)	(0.071)			
Time	0.0919	0.0387	0.0744			
	(1.840)	(0.030)	(0.067)			
Check	0.133	0.00455	-0.0245			
	(1.837)	(0.029)	(0.076)			
Communicating				0.546	0.0945***	0.237***
				(1.461)	(0.022)	(0.048)
Monitoring				0.278	0.0357	0.0408
				(1.270)	(0.022)	(0.050)
Science attitude	22.91***			22.90***		
	(1.816)			(1.822)		
Aspiration	27.08***			27.01***		
	(1.927)			(1.910)		
Possessions at home	1.239	0.0425**	0.258***	1.628	0.0457***	0.259***
	(1.206)	(0.018)	(0.035)	(1.198)	(0.017)	(0.035)
Possessions at home11	7.070	0.114			0.101	
	(9.471)	(0.166)			(0.169)	
Number of books at home	8.774***	0.0472**	0.139***	8.780***	0.0486**	0.139***
	(1.311)	(0.020)	(0.047)	(1.301)	(0.021)	(0.047)
Ref: High school or below						
Mother: Higher than University			0.709***			0.687***
			(0.217)			(0.216)
Mother: Junior college	10.94***	0.0790	-0.259	10.81***	0.0667	-0.253
	(4.047)	(0.059)	(0.215)	(4.116)	(0.059)	(0.215)
Mother: Unknown	-9.894***		0.270	-9.880***		0.261
	(3.692)		(0.165)	(3.719)		(0.167)
Father: Higher than University		0.102*	1.135***		0.128**	1.143***
		(0.060)	(0.184)		(0.060)	(0.184)
Father: Junior college	-4.733		-0.754***	-4.442		-0.766***
	(5.669)		(0.219)	(5.553)		(0.218)
Father: Unknown		0.0761	0.338*		0.0860	0.334*
		(0.058)	(0.177)		(0.058)	(0.179)
Children born between January 1and April 1	-10.78***	0.0583	-0.103	-10.80***	0.0556	-0.112
	(3.587)	(0.049)	(0.120)	(3.614)	(0.049)	(0.117)
Experiences of being bullied						
Total enrolment of students (in hundreds)		-0.0199		-1.120	-0.0156	-0.0202
		(0.019)		(1.155)	(0.020)	(0.029)
Location of school	4.778**	-0.0419	0.157*	5.216**		0.170**
	(2.363)	(0.043)	(0.083)	(2.391)		(0.084)
Private or national school	15.42	0.0976	0.897***	12.27	0.206*	0.854***
	(12.350)	(0.092)	(0.202)	(12.640)	(0.122)	(0.212)
School-P	14.90***		0.147	16.00***	-0.100*	0.151
	(3.988)		(0.108)	(4.121)	(0.055)	(0.108)
Income level of school area			0.133			0.150
			(0.115)			(0.120)
% of economically disadvantaged students					-0.00905	-0.0170
					(0.008)	(0.013)
Class size		-0.00763	-0.0200			
		(0.009)	(0.013)			
Random intercept of school	1			1		
	(0)			(0)		
Constant	335.5***	-0.553**		333.2***	0.508	
	(32.470)	(0.274)		(31.810)	(0.487)	
Observations	1789	1789	1789	1789	1789	1789

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 13 = 139422 and Model 14 =139405.

Table 2.9 Results for Eighth Grade (Female: Science)

	Female							
	Model 15				Model 16			
VARIABLES	Achievement	Attitude	Aspiration	Talk	Achievement	Attitude	Aspiration	Communicating
Ask	-3.302*	-0.0565*	0.0192					
	(1.867)	(0.031)	(0.069)					
Talk	0.347	0.177***	0.134*					
	(2.112)	(0.034)	(0.074)					
Time	3.223*	0.0185	0.0829					
	(1.903)	(0.029)	(0.063)					
Check	-2.427*	0.0625**	-0.0963					
	(1.432)	(0.027)	(0.064)					
Communicating					-1.999*	0.0782***	0.111**	
					(1.212)	(0.021)	(0.044)	
Monitoring					0.359	0.0663***	-0.0189	
					(1.210)	(0.018)	(0.047)	
Science attitude	19.57***				19.83***			
	(1.514)				(1.480)			
Aspiration	28.67***				28.73***			
	(2.169)				(2.140)			
Possessions at home	4.077***	0.0194	0.236***	0.217***	4.162***	0.0164	0.240***	0.158***
	(1.108)	(0.017)	(0.033)	(0.031)	(1.110)	(0.018)	(0.033)	(0.022)
Possessions at home11			-0.516				-0.504	
			(0.397)				(0.396)	
Number of books at home	9.399***	0.119***	0.159***		9.328***	0.125***	0.151***	
	(1.344)	(0.022)	(0.050)		(1.339)	(0.022)	(0.050)	
Ref: High school or below								
Mother: Higher than University	2.931	0.0754	1.347***		2.927	0.0905*	1.316***	
	(4.472)	(0.055)	(0.228)		(4.483)	(0.054)	(0.228)	
Mother: Junior college	6.104		-1.037***		5.801		-1.023***	
	(4.049)		(0.218)		(4.057)		(0.217)	
Mother: Unknown		0.127	0.563***			0.140	0.542***	
		(0.083)	(0.195)			(0.086)	(0.192)	
Father: Higher than University	4.924		1.151***		5.384*		1.112***	
	(3.091)		(0.150)		(3.146)		(0.155)	
Father: Junior college			-0.735***				-0.705***	
			(0.204)				(0.208)	
Father: Unknown		-0.0474	0.280			-0.0651	0.255	
		(0.066)	(0.172)			(0.067)	(0.172)	
Children born between January 1and April 1	-2.973	-0.0809	-0.263**		-2.761	-0.0764	-0.262**	
	(3.199)	(0.051)	(0.119)		(3.198)	(0.052)	(0.119)	
Experiences of being bullied								
Total enrolment of students (in hundreds)					0.669			
					(1.050)			
Location of school		-0.103***						
		(0.038)						
Private or national school			1.700***			-0.120	1.573***	
			(0.251)			(0.141)	(0.267)	
School-P						-0.0774	0.167	
						(0.0620)	(0.114)	
Income level of school area	13.22***	0.0563	0.433***		10.62***	0.0964	0.351**	
	(3.827)	(0.074)	(0.141)		(3.692)	(0.081)	(0.143)	
% of economically disadvantaged students		0.0719	0.0727			0.0423	0.0869	
		(0.061)	(0.101)			(0.062)	(0.101)	
Class size			-0.0137				-0.0174	
			(0.015)				(0.016)	
Random intercept of school	1				1			
	(0)				(0)			
Constant	403.2***	-0.997***			398.1***	-0.190		-1.039***
	(10.280)	(0.298)			(11.770)	(0.506)		(0.177)
Observations	1812	1812	1812	1812	1812	1812	1812	1812

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 15 = 164742 and Model 16 =171096.

Chapter 3: Effects of Maternal and Paternal Involvement on Adolescents' Academic Achievement and Aspiration

3.1 Introduction

Students' achievement is a major concern in many societies. A number of studies show that parental involvement increases students' achievement and actively encourage it (e.g., Hoover-Dempsey et al., 2005; Blazer, 2009; Galindo and Sheldon, 2012). However, little is known about individual contribution that mothers and fathers make to their children's education since most studies do not distinguish between maternal and paternal involvement. In addition to this, literature is still largely focused on mothers (Kim and Hill, 2015) even though researchers suggest that fathers contribute in important ways (Lewis and Lamb, 2003; Lamb, 1975; Sarkadi et al., 2008). Therefore, it is important to examine the effects of mothers and fathers independently in order to understand the mechanism behind academic achievement better.

Besides, most of the studies use measures aggregating several types of involvement, which makes it difficult to interpret the precise effects of a particular measure (Sui-Chu and Willms, 1996). The present study uses two types of involvement separately: parental discussion and aspiration. Studies show that these types of involvement positively influence educational achievement (e.g., Singh et al., 1995; Sui-Chu and Willms, 1996) whereas how these maternal and paternal involvement influence educational achievement is still not clear. Investigating

how it influences academic achievement will inform policymakers and schools about how mothers and fathers can influence their children's performance and help them design better policies to maximize their influence.

This study examines independent effects of maternal and paternal involvement (discussion and aspiration) on male and female adolescents' grade. Also, this study takes into account the indirect effects of parental involvement and examines whether adolescent's educational aspiration mediate the associations between parental involvement and achievement. Samples of middle school students were analysed separately according to their gender by using a generalised structural equation model. The unique contribution of this study is that it reveals that both maternal and paternal involvement influence adolescents' grades and aspiration independently. Specifically, two fundamental differences are found. First, while higher maternal aspiration is associated with higher grades for both male and female adolescents, higher paternal aspiration only shows the same effect against females. Second, maternal discussion does not show significance toward educational aspiration, whereas paternal discussion is significant and positive toward both males and females. In this study, an analysis of the differences and similarities between mothers and fathers is provided in light of the realities of family and gender roles in Japan.

3.2 Literature Review

3.2.1 Parental Involvement

Parental involvement includes a range of practices that are intended to promote children's motivation and educational achievement. Examples of parental involvement are discussing school with children and monitoring their progress. Hoover-Dempsey and Sandler (1995) states that parental involvement influences educational outcome through three mechanisms: modelling of school related behaviours and attitudes, reinforcing specific aspects of school

learning, and instruction. Various studies conclude that parental involvement in children's education has positive impacts on school achievement (e.g., Sui-Chu and Willms, 1996; Englund et al., 2004; Galindo and Sheldon, 2012), attitude (e.g., Fantuzzo et al., 2004; Shumow et al, 2011), and behaviour (e.g., Hill et al., 2004).

However, there are limitations in prior studies. The majority of them examine the effects of parental involvement without distinguishing between mothers and fathers' or only focusing on mothers' involvement. Even though the fathers' influence on child development is often assumed to be subordinate to that of the mothers (McBride et al., 2005), researchers suggest that fathers contribute to their children in important ways (Lewis and Lamb, 2003; Lamb, 1975; Sarkadi et al., 2008). Studies that examine paternal involvement on children's education are still limited and some of them only examine fathers' involvement. It is not clear if mothers and fathers make an independent contribution toward their children if only one side is examined. For example, Barnett et al. (1992) estimated separate models for mothers and fathers and found that sons' positive relationship with them was related to the son's low levels of psychological distress. However, when variables of sons' relationship with mothers and fathers were examined in the same model, only fathers' relationship was significant. Therefore, it is important to investigate both mothers and fathers effects simultaneously to see their independent effects.

In addition to the limited number of studies that investigate maternal and paternal involvement simultaneously, most of these studies have used aggregates of several types of involvement rather than one specific type of involvement. Using a measure that includes various types of involvement makes it difficult to interpret the precise effects of a particular measure (Sui-Chu and Willms, 1996) and it can also bring different results. For example, Flouri and Buchanan (2004) used a measurement of parental involvement that included four types of involvement (outing with father/mother, father/mother manages the child,

father/mother reads to the child, and father/mother is interested in their child's education) and found a positive relationship between both mother and father involvements and educational attainment. However, Hsu et al. (2010), by using a measurement that aggregated other four types of involvement (discussing of career plan, listening to children's thinking, participation in school, and monitoring behaviour), found that only mothers had an influence; and Harris et al. (1998), by defining involvement with six types of involvement (such as closeness, do things together, and if the child want to be like their mother or father when they become an adult), found that only fathers had positive and significant effects .

Therefore, the present study uses each type of involvement separately: parent-child discussion and parental aspiration. There is evidence indicating that certain types of involvement may be more strongly related to academic achievement than others (Singh et al., 1995; Fan and Chen, 2001; Castro et al., 2015; Fan, 2001). For example, Fan and Chen (2001) conducted a meta-analysis and found that parental aspiration/expectation for children have the strongest effects on academic achievement. Other studies also found positive associations between parental aspiration and academic achievement (e.g., Singh et al., 1995; Castro et al., 2015). In addition to parental aspiration, various studies also show a positive and significant association between parent-child discussion and academic achievement (e.g., Sui-Chu and Willms, 1996; Pong, 1997; Fan, 2001). For example, Sui-Chu and Willms (1996) examined the effects of four types of parental involvement (parents communicating with school, supervising children at home, participating in school activities and discussing school related matters with their children) on academic achievement among middle school students and found that discussion of school-related activities at home had the strongest relationship with academic achievement.

Thus, studies show positive influences of parental aspiration and parent-child discussion on children's academic achievement. However, most of these studies do not investigate mothers'

and fathers' effects simultaneously. McBride et al. (2005), however, is an exception. Their study defined parent-child discussion variables by measuring the frequency of parent discussions with children on three different topics (school activities or events, things the child had studied in class, and the child's experience in school) and estimated its effects of the mothers and the fathers on children's achievement. They did not find any significant associations for neither of the parents. However, the study examines children between the ages 5 to 12 altogether and ignores school levels (e.g., elementary and middle school). How parents get involved and the effects of their involvement may differ depending on the children's school level (Hill and Taylor, 2004; Patall et al., 2008). Therefore, the study may fail to examine the precise effects. More studies are needed to understand the effects of mothers' and fathers' discussion and aspiration on children's academic achievement.

3.2.2 Gender

Gender is socially constructed through culture and social means (West and Zimmerman, 1987; Connell, 1987). In other words, the behaviour of men and women is heavily shaped by the many pressures that individuals face in society. In the same way, patterns of parental involvement would be different for fathers and mothers as society holds different expectations toward each of them. Hoover-Dempsey and Sandler (1995, 1997) presented a theoretical model to understand why parents choose to become involved. According to the Hoover-Dempsey and Sandler's Model (the HDS model), parents' decision to become involved in their children's education is based on three factors: (1) parental role construction: parents' beliefs about what they are supposed to do in relation to their children's education, (2) parents' self-efficacy for helping children succeed in school, (3) parents' perception of invitations/demands and opportunities for involvement. Hoover-Dempsey and Sandler (1997) contend that parental role construction is the most important factor, and when it is significant,

positive involvement decision would be likely to occur. Parental role construction is described in part by general role theory: expectations held by groups for the behaviour of individual members are the major generator of roles and it is learned through experience (Hoover-Dempsey and Sandler, 1997; Biddle, 1986). That is if mothers are expected to involve in their children more compared to the fathers, they are likely to get more involved than the fathers. Likewise, Gender Congruence Theory postulates that parents' roles such as the caregiver and the breadwinner are influenced by their spouses (Maurer et al., 2001) and by the behaviour of other same-sex parents (Maurer and Pleck, 2006). Therefore, mother and father involvement may be different if the expectation that is held toward them and their experiences are different.

Studies and surveys show different expectations towards mothers and fathers. Traditional gender roles, such as women as caregivers and men as a breadwinner, are still rooted in many societies. For example, according to a survey conducted among Japanese men and women aged from the twenties to thirties, more than 80% answered they preferred wives do more chores than husbands (Cabinet Office Director General for Policies on Cohesive Society, 2015). Moreover, in school textbooks published in several different countries such as Britain, the United States, Singapore and Japan, females are presented as passive and home-oriented whereas males are presented as active and work-oriented (Jassey, 1998). It may imply children how women and men should behave. Researchers claim that these biases may have an impact on their values and personal and cognitive development (Jassey, 1998; Lee, 2014).

In several studies mothers are found to be more supportive and comforting compared to fathers who are more likely to encourage children to take risks, challenges and exploration (e.g., Paquette, 2004; Grossmann et al., 2002; Rogers et al., 2009). Since gender differences are products of socially constructed norms and values, these differences need to be interpreted with caution. However, as a matter of observable outcomes the findings suggest that fathers

and mothers may influence their children differently even though both of them play an important role in their children's education. Besides, when their involvement is different, investigating both maternal and paternal involvement simultaneously may help to understand what involvement is more effective for their children's education.

Studies also suggest that mothers and fathers have different influences depending on the gender of their children. Same-gender parent-child relationship is closer than the opposite-gender one. For example, daughters report higher intimacy levels with mothers than fathers (Konishi and Kurokawa, 2007). Likewise, compared to female adolescents, male adolescents report significantly greater emotional and behavioural involvement with fathers (Harris et al., 1998). Other studies also find that girls are more involved with their mothers and boys with their fathers (Starrels, 1994; Crouter et al., 1995).

Only a limited number of studies investigated the effects of mothers and fathers' involvement in relation to their children's gender. Dumka et al. (2009) examined Mexican origin seventh graders and found no relationship between mothers and fathers involvement with male and female school grades. Only mothers' harsh parenting (defined as punitive actions aimed at demonstrating parents' superior position) was significantly related to their daughters' grade. However, the study does not examine both maternal and paternal involvement in the same model. Hence their independent influences are unknown.

3.2.3 Educational Aspiration

Educational aspiration, which is the highest level of education children would like to attain, is also important for children's education. Studies have reported that educational aspiration in children is a significant predictor of academic achievement (Leung et al., 2010; Jung and Zhang, 2016). A number of studies have examined the effects of parental involvement on children's educational aspiration and they have found positive associations (e.g., Hill et al.,

2004; Berzin, 2010; Hill and Wang, 2015; Frostick et al., 2016; McNeal, 2015). For example, Hill and Wang (2015) found that parental monitoring is positively associated with aspiration. Also, McNeal (2015) found that parent-child discussion defined as discussing with parents about school programs, activities, and things studied in class positively predicted children's educational aspiration. However, most of the studies do not examine the effects of maternal and paternal involvement simultaneously.

Only a few studies have examined effects of mothers and fathers in the same study and the results are inconsistent. Lazarides et al. (2016) found that mothers' and fathers' high educational expectations for their children at 7^{th} year contributed to their children's high educational expectations at 9^{th} year positively. However, Geckova et al. (2010) found that mothers' support defined as closeness and availability for chatting does not predict secondary school students' academic aspiration, whereas fathers' support predicts it positively. Marjoribanks (1998) examined mothers and fathers influence also considering the children's gender and found that mothers' support defined as encouragement for schooling positively associated with both female and male students academic aspiration but fathers' support was only associated with male students.

3.1 Purpose of the Present Study

The aim of the study is to examine the independent effects of maternal and paternal involvement, parental discussion and aspiration, on children's educational academic achievement. Also, the study takes into account the indirect effects of parental involvement and examines whether students' educational aspiration mediate the associations between parental involvement and adolescents' achievement. To investigate discussion topics that are influential, the present study employs six different topics related to adolescents' schooling and their daily lives. It also investigates male and female students separately.

The present study looks into two research questions. 1) Does maternal and paternal involvement influence adolescents' achievement and educational aspiration independently? 2) Does parental involvement have a more significant influence on same-sex academic grade and aspiration than opposite-sex one? It is expected that both mothers and fathers influence adolescents' achievement and aspiration independently (Figure 3.1). However, it is hypothesised that associations between involvement, achievement and aspiration would be different by parents' gender. Since studies show that fathers are more likely to encourage children to face challenges (Paquette, 2004; Grossmann et al., 2002; Rogers et al., 2009), it is expected that the father would have a stronger influence on adolescents' educational aspiration. Also, based on the previous literature (Konishi and Kurokawa, 2007; Harris et al., 1998; Starrels, 1994; Crouter et al., 1995), it is hypothesised that same-sex parental involvement has a stronger influence on academic grade and aspiration than opposite-sex one.

3.2 Method

3.2.1 Data

This study makes secondary use of the Survey of Life Attitudes of Parents and Children (2011)[3]. Sample was selected based on a two-stage stratified random method and the survey was conducted in autumn of 2011, generating a nationally representative data set containing 3,192 ninth graders (14 to 15 years old) and their 3,197 parents. Data collection was conducted by means of two questionnaires: in the students' questionnaire, students provided information on their characteristics (e.g., gender), their academic aspirations, and parental-child discussion. In the parents' questionnaires, either mothers or fathers of the target adolescents were questioned and they provided information such as their characteristics (e.g., educational

[3] The data for this secondary analysis, "Survey on Life Attitudes of Parents and Children, 2011" deposited by the Office for the General Promotion of Policy on Youth Affairs and Childrearing, Cabinet Office, The Government of Japan, was provided by the Social Science Japan Data Archive, Center for Social Research and Data Archives, Institute of Social Science, The University of Tokyo.

background), household income, and family background. After excluding missing data, this study arrived at a final sample of 1,801 ninth grade students (861 female and 940 male) and their respective parents.

3.2.2 Variables

Grade

As a measure of academic achievement, students' grade was used. The measure of students' grade was based on the question from the students' questionnaires: "How are your grades compared to the students from your year?". Answers were coded as follows: 1 = lower, 2 = a little bit lower, 3 = average, 4 = a little bit higher, 5 = higher.

Educational Aspiration of Adolescents

The measure of students' educational aspiration was based on the question from students questionnaires: "How far do you want to go in your education?". Original responses given were 1 = middle school, 2 = secondary school, 3 = vocational school 4 = technical college or junior college, 5 = university, 6 = graduate school. These responses were converted in total years of schooling (from elementary school) that students want to pursue: 9=middle school, 12 = secondary school, 14 = vocational school, technical college and junior college, 16 = university, 18 = graduate school.

Parent-child Discussion

Parent-child discussion was measured with six items from students' questionnaires. Students were asked to rate frequency of conversation regarding six different topics with their mothers and fathers: about episodes from school, about study and grades, about future and life course after graduation, about friends, about society and news, and about hobby and extracurricular

activities. All items were rated on a four-level scale and they were coded as follow: 1 = do not talk about it at all, 2 = talk about it rarely, 3 = talk about it sometimes, and 4 = talk about it often.

Educational Expectation of Parents

The measure of parents' educational aspiration was based on the question from parents' questionnaires: "How far do you want your child to go in his/her education?" Respondents also answered their partner's educational aspiration. Responses given were 1 = middle school, 2 = secondary school, 3 = vocational school 4 = technical college or junior college, 5 = university, 6 = graduate school. These responses are converted in total years of schooling (from elementary school) as follows: middle school = 9, secondary school = 12, vocational school, technical college and junior college = 14, university = 16, graduate school = 18.

Control Variables

Several student and family background variables were included in the models to control statistically for important background factors: socioeconomic background, family structure and relationship, type of school, extracurricular activities and other.

Characteristics of adolescents' socioeconomic background are measured by the highest level of education completed by parents, employment status of parents, and household income. The highest level of education completed by the mother and father were asked to parents and the responses are converted in total years of schooling (from elementary school) for each and numbered as follow: middle school = 9, secondary school = 12, vocational school = 14, technical college or junior college = 14, university = 16, graduate school = 18. Type of employment of mothers and fathers was asked in the parents' questionnaires and is categorized as follows: management position (since number of mothers that is categorized in this type is

scarce, this category was created only for fathers), regular employment, contractual employment, non-employed, other. Each type of employment status was dummy coded. Household income of the previous year was also reported by the parent. They were asked to choose from twelve ranges of income. For the purposes of this study, the ranges were converted into single numbers by averaging their upper and lower thresholds. All answers are in ten thousands of Japanese Yen: less than 100 = 50, between 100 and 200 = 150, between 200 and 250 = 225, between 250 and 300 = 275, between 300 and 350 = 325, between 350 and 400 = 375, between 400 and 550 = 475, 550 and 700 = 625, between 700 and 850 = 775, between 850 and 1000 = 925, between 1000 and 1200 = 1100, and more than 1200 = 1800.

Adolescents' family structure and relationship were measured by the number of siblings, how adolescents perceive their parents and the relationship between their mothers and fathers. Parents were asked the number of siblings of the adolescents. Students were asked if mothers would listen to them and advice in times of trouble. The same question was asked about fathers. The dummy variable created for each answer was coded as 1 = yes and 0 = no. Students were also asked if they think that their parents get along well. The answers were rated on a five-level scale and coded as follow: 5 = yes, 4 = maybe yes, 3 = normal, 2 = maybe not, and 1 = no.

Types of school that adolescents were enrolled for were coded for each type of school: public school, national school, and private school.

Lessons adolescents take outside of school and hours of self-studying were also included as control variables. Parents were asked if their children take any lessons besides school: cram school, private teacher lessons, distance learning, and other lessons related to academic subjects such as English lessons and calculation on the abacus. Dummy variables were created for each type of lesson. Hours of study during weekdays and weekends was also measured. For hours of study during weekdays, students chose from six answers. The ranges were converted into single numbers by averaging their upper and lower thresholds. All answers are in hours:

not at all = 0, less than 30 min = 0.15, more than 30 minutes and less than an hour = 0.45, more than 1 hour and less than 2 hours = 1.5, more than 2 hours and less than 3 hours = 2.5, and more than 3 hours = 4.5. As for hours of study on weekends, students chose from seven answers: not at all = 0, less than 30 min = 0.15, more than 30 minutes and less than an hour = 0.45, more than 1 hour and less than 2 hours = 1.5, more than 2 hours and less than 3 hours = 2.5, more than 3 hours and less than 4 hours = 3.5, and more than 4 hours = 6.

The city size where the adolescents live is categorised in 5 levels. This study uses the values shown in parenthesis which is the average (unit: ten thousand) between the maximum and minimum population in each size range: town and village = 1, a city that population is less than a hundred thousand = 5, a city where the population is more than hundred thousand = 15, a city where the population is more than two hundred thousand = 60, big city = 150.

The variables mentioned above were used to control adolescents' aspiration and grade except that extracurricular activities and hours of study during weekdays and weekends were used only to control adolescents' aspiration and not grade. Maternal involvement is controlled by income, mother's education level, and type of employment only. Paternal involvement is controlled by income, father's education level, and type of employment only.

3.2.3 Estimation Method

Generalised structural equation modelling (GSEM), with an ordered logit link for estimating adolescents' grade, was used to analyse the effects of parental involvement. GSEM is a version of structural equation modelling (SEM) that allows for broader applications. SEM can depict relationships among variables by using various types of models and testing patterns of relationships among a set of observed and latent variables (Schumacker and Lomax, 2010). OLS regression is limited in that and it does not allow for simultaneous examination of multiple mediational chains (Bryan et al., 2007). SEM, on the other hand, examines direct and

indirect effects simultaneously and tests multiple mediators, multiple dependent variables, complex mediational chains, and specific indirect effects within those complex chains (Bryan et al., 2007; Gunzler et al., 2013). Instrumental variables (IV) could be another option, but in order to use IV, the structure of the model has to be decided beforehand. SEM allows the examination of complex structured models more flexible. The GSEM for this model for the *i*th adolescents is given by:

$$Y_i^* = \gamma_0 + \gamma_1 A_i + \gamma_2 M_i + \gamma_3 P_i + \gamma_4 X_{1,i} + u_i \quad (1)$$

$$Y_i \begin{cases} 1 \; if \; Y_i^* \leq \mu_1 \\ 2 \; if \; \mu_1 < Y_i^* \leq \mu_2 \\ \vdots \\ 5 \; if \; \mu_4 < Y_i^* \end{cases}$$

$$A_i = \beta_0 + \beta_1 M_i + \beta_2 P_i + \beta_3 X_{2,i} + \varepsilon_i \quad (2)$$

$$P_i = \theta_0 + \theta_1 X_{3,i} + \epsilon_i \quad (3)$$

$$M_i = \delta_0 + \delta_1 X_{4,i} + \tau_i \quad (4)$$

Where:

Y_i^* = latent variable of adolescents' educational aspiration, whose values determine what the observed ordinal variable Y_i equals

Y_i = grade of adolescents *i*

A_i = educational aspiration of adolescents *i*

$\beta_0 \; and \; \gamma_o$ = intercept

M_i = vector of maternal involvement variables

P_i = vector of paternal involvement variables

$X_{1,i}$ = vector of control variables for Eq. (1)

$X_{2,i}$ = vector of control variables for Eq. (2)

$X_{3,i}$ = vector of control variables for Eq. (3)

$X_{4,i}$ = vector of control variables for Eq. (4)

ε_i and u_i = residual term

The direct and indirect effects are all examined in a single model (see Figure 3.2) by using Eq. (1), (2), (3), and (4). The final models were decided among converged models based on Akaike Information Criterion (AIC) (Akaike, 1987). The AIC measure is used to compare models with differing numbers of latent variables. It aims to identify those models that represent a good compromise between model fit and model complexity and selects most relevant variables to prevent overfitting (Garamszegi and Mundry, 2014; Sauerbrei et al., 2007). Lower values for AIC indicate a better model fit. Therefore, some variables that are not important are dropped from the model based on the AIC. The results did not change significantly from the full model (see Appendix B from Table B.1 to B.7 for the detailed results). Each value of AIC for the final models are as follows: for a female model (4894), for a male model (5791).

3.2.4 Descriptive Statistics

Table 3.1 provides the descriptive statistics for male and female adolescents. Overall, consistent with previous studies, involvement is more frequent between same-sex parent-adolescents: mothers tend to discuss with female adolescents more frequently compared to male adolescents and fathers tend to discuss with male adolescents more frequently than female adolescents. Likewise, more male adolescents answered that fathers would listen and give advice when they had problems compared to mothers and more female adolescents answered mothers would listen and give advice when they had problems compared to fathers. The descriptive statistics also show that both maternal and paternal aspiration is higher for male adolescents than female adolescents, which reflects traditional gender roles still common

in Japan.

3.3 Results

The results are shown in Table 3.2 and 3.3 Results for male adolescents are illustrated in Figure 3.3 and results for female adolescents are illustrated in Figure 3.4. Each result is discussed at 5% significant level.

Male Adolescents

The results show that both maternal and paternal involvements are independently associated with male adolescents' grades and aspiration. Also, males' grades are indirectly influenced by the positive effects of father-child discussion and parental aspiration (both mothers and fathers) on the adolescent's own aspiration.

As for the effects of parental discussion on grades, results show that discussing school related topics have significant and positive effects: discussing episodes from school with mothers and discussing study and grades with father have positive effects. That is male adolescents tend to get a higher grade as parents discuss school related matter more frequently. On the other hand, discussing friends with mothers and discussing hobby and extracurricular activities with fathers are negatively associated with grades. For the effects of parental discussion on adolescents' aspiration, discussing future and life course after graduation with fathers is positive and discussing friends is negative. Discussing with mothers does not show significant influences.

As for the effects of parental aspiration, maternal aspiration is positively and significantly related to both grade and aspiration whereas paternal aspiration is only associated with aspiration. However, at 10% significance level, the relationship between paternal aspiration and grades is significant and positive.

Socioeconomic variables that were associated with grades are as follows. Higher levels of education for mothers are positively associated with male adolescent's grades. Among family structure and relationships variables, only relationship of parents has a positive sign. As for extracurricular activities, distance learning is positive, whereas a private teacher is negative. Hours of study during weekends are also positive. Finally, living in a larger city has a negative effect on male's grades. Socioeconomic variables that have an effect on adolescent's aspirations are fathers' contractual employment with a negative sign, and household income with a positive one. Type of school is not significantly associated with either grade or aspiration.

Female Adolescents

Likewise the results for male adolescents, results show that both maternal and paternal involvements are independently associated with grade and aspiration. Also, discussing specific topics with fathers and maternal and paternal aspiration influence grade indirectly through influencing adolescents' educational aspiration positively.

As for the effects of parental discussion on grades, results are similar to male adolescents. Discussing study and grades with mothers and fathers are positive, whereas discussing hobby and extracurricular activities with fathers are negative. Discussing with fathers about future and life course after graduation has also shown a negative association with grades. For the effects on aspiration, discussing society and news with fathers is positively associated with aspiration. As well as the results for male adolescents, discussion with mothers does not have a significant influence on aspiration.

As for the effects of parental aspiration, both maternal and paternal aspiration is significantly and positively associated with both grades and aspiration. Results show that both maternal and paternal aspiration is more significantly associated with aspiration (1%

significance) than grades (5% significance).

Socioeconomic status is only associated with aspiration and not grades: a higher level of fathers' education and mothers' contractual work has positive associations. Unexpectedly, household income does not have a significant association with either grades or aspiration. As family structure and relationship, compared to the results of male adolescents, different associations are found. Unlike male adolescents, relationship of parents does not have significant effects. On the other hand, when mothers would listen and give advice when she had problems, it has a positive influence on grades. Also, number of siblings is negatively associated with grades even though it does not have significant effects on male adolescents. As for extracurricular activities, like male adolescents, distance learning is positively associated with the grade. On the other hand, other activities and hours of studying do not have any significant effects. As well as male adolescents, type of school does not have a significant effect. The size of the city also does not have significant effects.

Robustness Check

Robustness of the results was examined for two types of parental involvement: parental aspiration for male and female adolescents and discussion about study and grades for female adolescents. For these two types, parental involvement is significantly associated with educational outcome for both mothers and fathers and, therefore, there is a possibility that there are multicollinearity issues between maternal and paternal involvement variables (correlation of maternal and paternal aspiration is 0.7486 for females and 0.7048 for males and discussing study and grade is 0.4025).

Firstly, robustness check of the results of paternal aspiration was conducted for both male and female adolescents by dropping observations of mothers that have higher aspiration (533 observations for females and 728 observations for males whose maternal aspiration is 16 and

18 school years): the final sample is 328 for females and 212 for males. Results kept consistent with the original one. Secondly, robustness check of the results of maternal aspiration was conducted for both male and female adolescents by dropping observations of fathers that have higher aspiration (519 observations for females and 719 for males whose paternal aspiration is 16 and 18 school years): the final sample is 342 for females and 221 for males. The effects of the maternal aspiration were consistent with the original one except for female adolescents' grade: maternal aspiration was not significantly associated with female adolescents' grade. Further checks were conducted for female adolescents (total 861 observations) by dropping the variable of paternal aspiration and the results were the same of original one: maternal aspiration is positively and significantly associated with female adolescents' grade and aspiration. Therefore, it is possible that there is a correlation problem and the result of maternal aspiration on female grade might not be robust. Another possible explanation for this is that when paternal aspiration is lower, maternal aspiration does not have significant effects on female adolescents' grade.

Finally, robustness check of the results of discussion about study and grade was conducted for female adolescents. As for the effects of fathers, estimation results using the sample that dropped mothers often discussing (dropped 430 observations coded as 4 leaving a final sample of 431) showed consistent results with the original one. Likewise, as for the effects of mothers, the estimation result using the sample that dropped fathers discussing it often (dropped 175 observations coded as 4 and the final sample is 765) shows the consistent results with the original one. All the estimation results are presented in Appendix B (from Table B.8 to B.13).

3.4 Discussion

The present study investigates the effects of maternal and paternal involvement on adolescents' academic grade. It also examines the indirect effects of parental involvement on

the grades through adolescents' educational aspiration. Results show that maternal and paternal involvement influence adolescents' grades independently. Also, adolescent's educational aspirations mediate the association between parental involvement and academic grade.

For the relationship between parental discussion and adolescents' grade, discussing study and grades with fathers is positive and significant for both female and male adolescents, whereas discussing it with mothers is only related to female adolescents. Also, discussing episodes from school with the mother is only positively related to male adolescents' grade. Even though these different associations between parental discussion and adolescents' grade are difficult to interpret, the topics that are related to adolescents' schooling seems to be more influential for academic grade compared to other topics.

For the relationship between parental discussion and adolescents' educational aspiration, discussion with fathers has a significant effect on educational aspiration whereas discussion with mothers has no significant effects on it. It also implies that discussion with fathers has a positive influence on academic grade through aspiration. Also, the topics that have a positive influence on educational aspiration differ according to the children's gender. Discussing future and life course after graduation is positively associated with males and discussing society and news with fathers is positively associated for females.

Some possible reasons are considered for this. For the effects of discussing future and life course after graduation with fathers, previous studies show that compared to mothers, fathers are more likely to encourage children to take risks, challenges and explorations (Paquette, 2004; Grossmann et al., 2002; Rogers et al., 2009). Even though gender is socially constructed (West and Zimmerman, 1987; Connell, 1987), these differences may influence adolescents differently. Therefore, it is likely that fathers tend to encourage male adolescents to embrace academic challenges when they discuss future and life course after graduation and it may enhance their academic aspiration. On the other hand, the topic is not significantly associated

with female adolescents' aspiration. A possible reason is that fathers do not discuss with female adolescents in the same way as they do when they discuss with males because fathers have a relatively low aspiration towards females (see Table 3.1). Another explanation is that encouraging academic challenges may not be influential for females.

Two possible backgrounds are considered for the significant association between discussing society and news with fathers and female adolescents' aspiration. Firstly, it is possible that females are less likely to be able to imagine their success in business compared to males since traditional gender roles are still rooted in Japanese society. In addition to this, compared to men, women have fewer opportunities to acquire higher positions at a workplace. Studies indicate that Japanese women face steeper inequality as they move up to higher managerial positions (Yamaguchi, 2013; Yoosik and Yamaguchi, 2016). Indeed, women's percentage share of all managers in Japan is only 11.1%, while the United States shows 42.7% and the United Kingdom 34.2% (International Labour Office, 2015). Secondly, fathers may have more information regarding business compared to mothers. As it is shown, men have more opportunities to acquire higher positions at workplaces and it may enable them to gain more information about business and career. Therefore, for female adolescents, information about society and news including business from fathers may enable them to imagine their success in business or raise their interests towards the outside world, and in turn, it enhances their aspiration. Also, since these conditions are socially constructed, mothers could also play the same roles as fathers if they had equal working opportunities as them.

For the relationships between parental aspiration and adolescents' grade and aspiration, maternal aspiration is significantly associated with both independent variables for both males and females. Paternal aspiration follows a similar pattern, except that it did not achieve a 5% significance level in the estimation of male's grades (it is significant at 10% level). A possible explanation for the more significant associations from maternal aspiration is that middle school

students are more likely to spend time with their mothers (Ueno and Suzuki, 1994). Therefore, mothers may have more opportunities to influence their children's educational aspiration and grade than fathers do.

On the other hand, as for the relationship between parental aspiration and adolescents' aspiration, when the parent is the same sex as the child, he or she has stronger influence: the coefficient of maternal aspiration is 0.367 for male adolescents and 0.441 for female adolescents, the coefficient for paternal aspiration is 0.344 for male adolescents and 0.207 for female adolescents. Likelihood ratio test was conducted to test the differences and the difference was significant at 5% significant level.

Some negative associations are also found. Discussing future and life course after graduation with fathers is negatively associated with female adolescents' grades. Taking into consideration the fact that fathers tend to have higher aspirations toward males, it is possible that the purpose of the discussion might be different depending on if fathers discuss it with female or male adolescents: fathers may discuss with males to encourage them to have higher aspirations, whereas they may discuss with females to intervene when they record bad grades.

Discussing friends has a negative association with male adolescents' educational outcome: discussing it with mothers is negatively associated with grades and with fathers is negatively associated with aspiration. Mears et al. (1998) found that male adolescents are more likely to have delinquent friends and to be more strongly affected by them than females. Also, affiliating with friends who engaged in problem behaviour was associated with a lower level of academic achievement among middle school students (Véronneau, and Dishion, 2011). Therefore, it is likely possible that the negative associations imply parents' intervention for male adolescents' negative peer relations.

Also, discussing hobby and extracurricular activities with the father is negatively associated with both the male and female students' grade. On the other hand, discussing it with the mother

does not have significant influences on them. Lam et al. (2012) found that fathers as compared to mothers are more involved in leisure (e.g., sports, outdoor play, hanging out) and media use activities (e.g., watching TV, reading magazines and newspapers), with their children. Therefore, it is possible that when they discuss hobby and extracurricular activities, it is more likely that they are discussing leisure and fun activities that are not related to academic achievement, which may distract their children from studying. However, cautious interpretation of results is required because the sample of this study has only ninth graders and the data was collected in autumn. In Japan, competitive high school entrance examinations are administered in winter. Therefore, as ninth graders are preparing for exams, they are likely to be highly stressed and in such a situation, discussing hobby and extracurricular activities may distract them from studying and influence their grades and aspiration negatively.

Even though descriptive statistics largely show that mothers discuss with female adolescents more often than males and fathers discuss with male adolescent more frequently than females, results did not show strong tendencies of same-sex parent-adolescent associations between parental discussion and adolescents' educational grade and aspiration. The same-sex parent-adolescents association was found only between parental aspiration and adolescents' aspiration. The results indicate that even though same-sex parent-adolescent relationship may be stronger in some associations, both maternal and paternal involvement can influence adolescents' grade and aspiration regardless of their gender.

Limitation

Adolescents' grade was measured based on their reports on five items. Therefore, future studies need to use more objective indicators of achievement. Also, the grade of each subject is not known from the questionnaires and the study could not examine the association between parental involvements on scores of a specific subject. Additionally, concerning the explanation

for the negative association of parental involvement, it is not possible to analyse whether a problem of inverse causal relationship explained the previous section applies to this case or not since cross-section data is used in the study. It is also possible that parents get involved more when their children receive good grades and have higher educational aspiration. In this study, it was impossible to analyse such causality because the data used in the present study does not include information on previous grades and achievements. Further study using panel data is needed in order to test the causal relationships. Nevertheless, by controlling for the adolescent socioeconomic status, this study provides important information on the role of mothers and fathers in adolescents' education.

3.5 Conclusion

This study investigated the effects of maternal and paternal involvement, parental discussion and aspiration, on male and female adolescents' academic achievement and how adolescents' educational aspiration mediates the relationships between parental involvement and grades. Samples of middle school students were analysed separately according to the adolescents' gender. The analyses were conducted by using a generalised structural equation modelling. The results show that both maternal and paternal involvement influences adolescent's academic outcome independently. Adolescent's educational aspirations mediate the association between parental involvement and academic grade. Also, discussion topics that are related to adolescents' schooling are more significantly and positively associated with grade.

Results provide valuable insight for educators and policymakers as they develop policies to enhance children's education. Given the findings that both mothers and fathers independently influence adolescents' grades and aspiration, schools and policymakers may need to develop policies to encourage both maternal and paternal involvement. For example, schools can provide seminars for parents to encourage discussion with their children about their study and

to learn how to discuss plans for high school entrance exams. Also, public policies designed to increase the time that working parents spend time with their children can be useful as well.

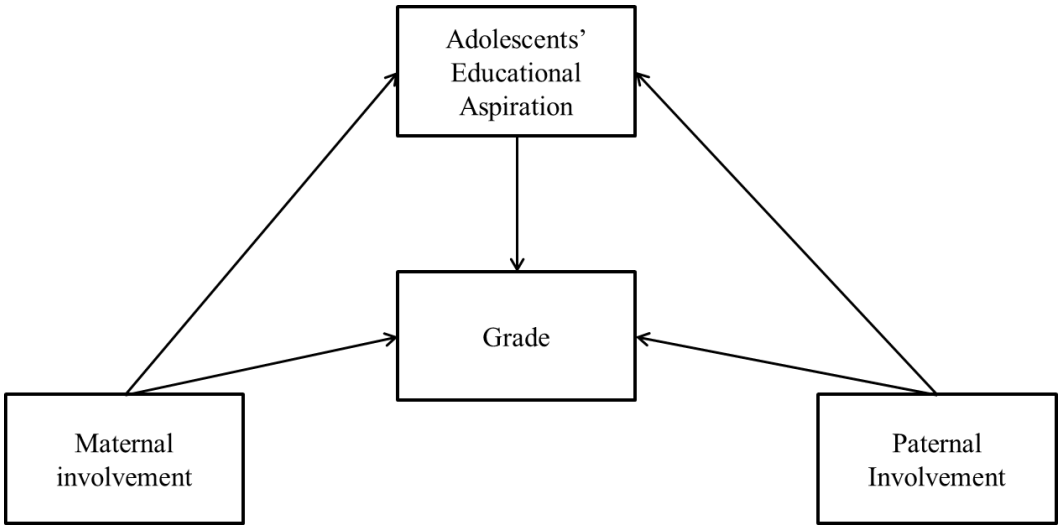


Figure 3.1 Hypothesised Model

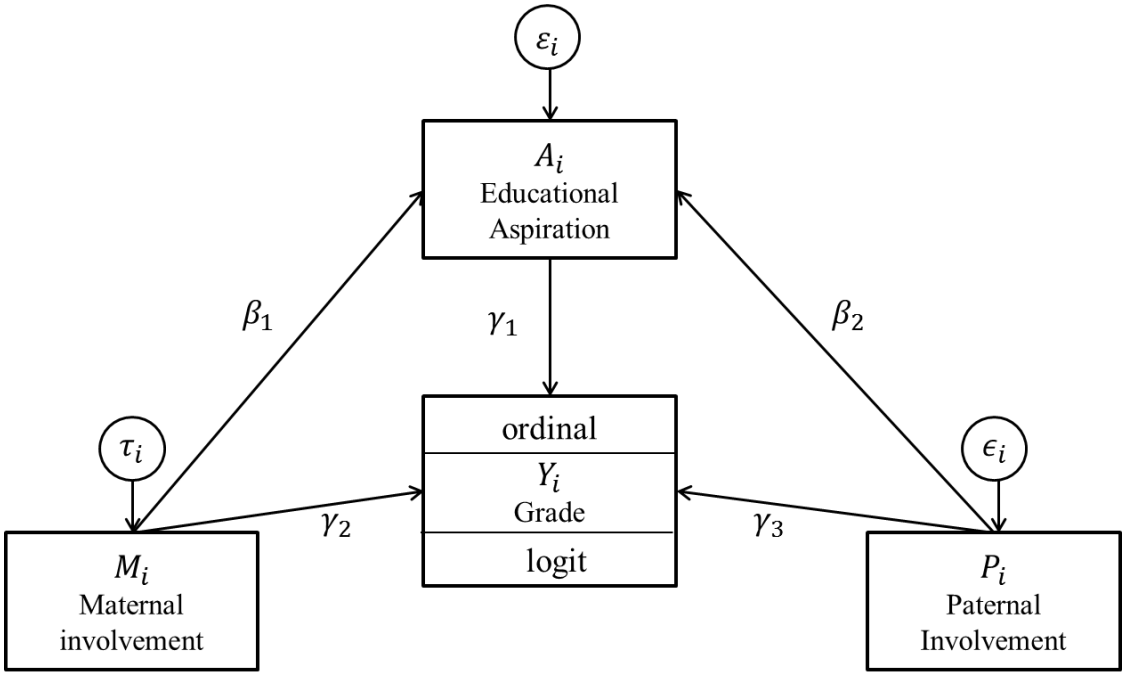


Figure 3.2 Model of the Effects of Maternal and Paternal Involvement on Adolescents' Educational Outcome

Control variables are omitted from the figure to facilitate visualization.

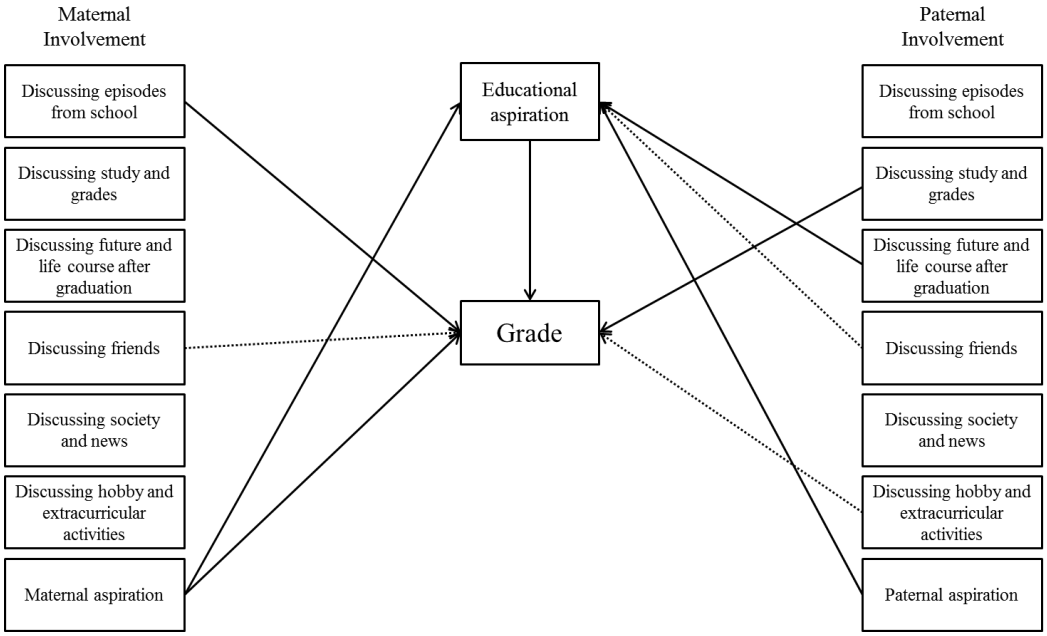


Figure 3.3 Results for Male Students

SEM depicting mediation effects of educational aspiration between parental involvement and grade for male students. Solid lines represent positive effects and dotted lines represent negative effects. Only significant paths ($p<.05$) are shown.

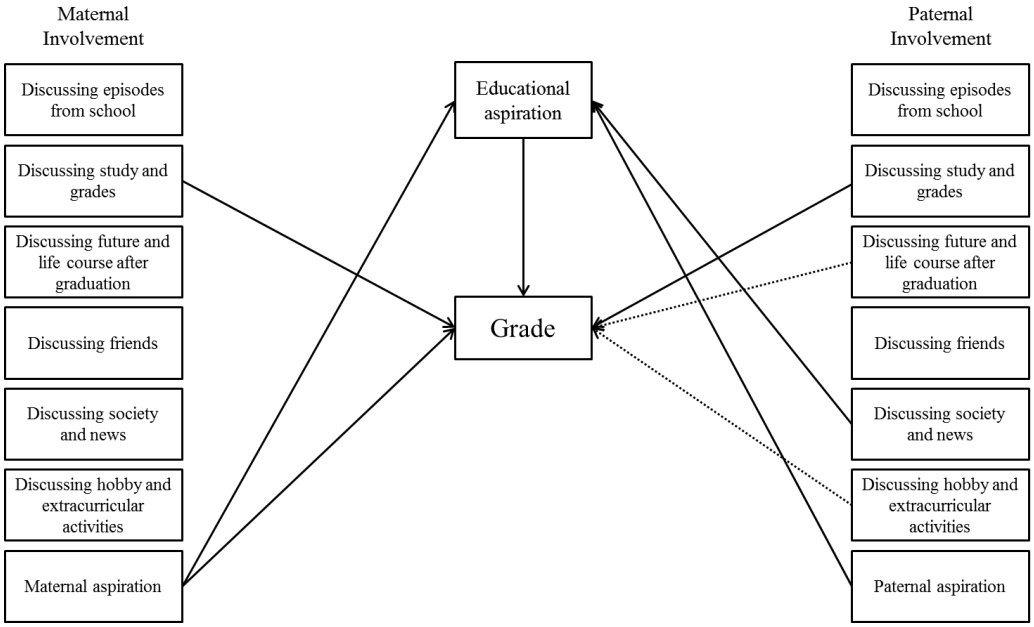


Figure 3.4 Results for Female Students

SEM depicting mediation effects of educational aspiration between parental involvement and grade for female students. Solid lines represent positive effects and dotted lines represent negative effects. Only significant paths ($p<.05$) are shown.

Table 3.1 Descriptive Statistics
(Male: N= 940, Female: N=861)

	Male				Female			
Variable	Mean	Std. Dev.	Min	Max	Mean or %	Std. Dev.	Min	Max
Grade	3.09	1.31	1	5	3.12	1.24	1	5
Adolescents' educational aspiration	15.12	1.79	9	18	15.02	1.48	9	18
Discussion								
Mother: about episodes from school	3.08	0.84	1	4	3.52	0.71	1	4
Mother: about study and grades	3.18	0.78	1	4	3.35	0.76	1	4
Mother: future and life course after graduation	3.09	0.83	1	4	3.28	0.80	1	4
Mother: about friends	2.88	0.92	1	4	3.30	0.86	1	4
Mother: about society and news	2.44	0.96	1	4	2.54	0.94	1	4
Mother: about hobby and extracurricular activities	2.71	0.97	1	4	2.93	1.00	1	4
Father: about episodes from school	2.48	0.94	1	4	2.53	0.99	1	4
Father: about study and grades	2.74	0.92	1	4	2.66	0.96	1	4
Father: future and life course after graduation	2.71	0.93	1	4	2.52	0.96	1	4
Father: about friends	2.29	0.97	1	4	2.21	1.01	1	4
Father: about society and news	2.44	1.01	1	4	2.37	1.00	1	4
Father: about hobby and extracurricular activities	2.53	1.02	1	4	2.34	1.01	1	4
Maternal aspiration	15.38	1.47	12	18	14.99	1.50	12	18
Paternal aspiration	15.28	1.63	9	18	14.85	1.63	12	18
Years of education completed by mother	13.62	1.77	9	18	13.51	1.65	9	18
Years of education completed by father	14.12	2.28	9	18	13.96	2.22	9	18
Mother: regular employment	0.19		0	1	0.20		0	1
Mother: contractual employment	0.51		0	1	0.52		0	1
Mother: other	0.07		0	1	0.07		0	1
Mother: non-employed	0.24		0	1	0.21		0	1
Father: regular employment	0.78		0	1	0.78		0	1
Father: contractual employment	0.06		0	1	0.05		0	1
Father: directors	0.03		0	1	0.05		0	1
Father: other	0.12		0	1	0.11		0	1
Father: non-employed	0.01		0	1	0.02		0	1
Household income	748.96	411.19	50	1800	699.91	378.39	50	1800
Father listens to adolescent and gives advice	0.53		0	1	0.33		0	1
Mother listens to adolescent and gives advice	0.67		0	1	0.72		0	1
Relationships of parents	3.97	1.11	1	5	3.96	1.11	1	5
Number of siblings	1.36		0	4	1.36	0.81	0	5
Public school	0.01		0	1	0.02		0	1
National school	0.11		0	1	0.10		0	1
Private school	0.87		0	1	0.88		0	1
Cram school	0.66		0	1	0.65		0	1
Private teacher	0.05		0	1	0.05		0	1
Distance learning	0.11		0	1	0.15		0	1
Lessons related with academic subjects	0.03		0	1	0.07		0	1
Hours of study during weekdays	1.95	1.44	0	4.5	2.25	1.40	0	4.5
Hours of study during weekends	2.87	2.58	0	7	3.30	2.55	0	7
Size of city	52.39	57.73	1	150	52.96	56.21	1	150

Table 3.2 Results of GSEM

	Model 1 Male		Model 2 Female	
Variables	Grade	Aspiration	Grade	Aspiration
Adolescents' educational aspiration	0.372***		0.375***	
	(0.048)		(0.062)	
Discussion				
Mother: episodes from school	0.268***	0.0909		
	(0.097)	(0.056)		
Mother: about study and grades			0.327***	
			(0.102)	
Mother: future and life course after graduation	0.167*			
	(0.090)			
Mother: about friends	-0.191**			
	(0.086)			
Mother: about society and news				
Mother: about hobby and extracurricular activities				
Father: about episode from school			-0.135	
			(0.090)	
Father: about study and grades	0.322***		0.367***	
	(0.095)		(0.109)	
Father: future and life course after graduation	-0.177*	0.135**	-0.260**	
	(0.101)	(0.054)	(0.103)	
Father: about friends		-0.151***		-0.0755*
		(0.053)		(0.039)
Father: about society and news	0.103		0.137*	0.168***
	(0.073)		(0.078)	(0.040)
Father: about hobby and extracurricular activities	-0.209***	0.0886*	-0.158**	
	(0.075)	(0.051)	(0.081)	
Maternal aspiration	0.160***	0.367***	0.161**	0.441***
	(0.062)	(0.042)	(0.070)	(0.036)
Paternal aspiration	0.0938*	0.344***	0.139**	0.207***
	(0.055)	(0.039)	(0.062)	(0.035)
Years of education completed by mother	0.0785**			
	(0.038)			
Years of education completed by father		0.0405*		0.0666***
		(0.023)		(0.018)
Employment status (ref. non-employed)				
Mother: regular employment			0.257	
			(0.159)	
Mother: contractual employment				0.153**
				(0.073)
Mother: other				
Father: regular employment			0.303*	
			(0.171)	
Father: contractual employment		-0.586**	0.520	
		(0.248)	(0.325)	
Father: directors				0.245
				(0.164)
Father: other				

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Effect of maternal aspiration on female adolescents' grade has to be taken cautiously since it might not be robust.

Table 3.3 Results of GSEM (Continuous Part from Table 3.2)

	Model 1 Male		Model 2 Female	
Variables	Grade	Aspiration	Grade	Aspiration
Household income		0.000318***		
		(0.000)		
Father listens to adolescent and gives advice				
Mother listens to adolescent and gives advice			0.467***	
			(0.155)	
Relationships of parents	0.152***			
	(0.059)			
Number of siblings	0.140*		-0.228***	
	(0.084)	(0.059)	(0.083)	
Type of school (ref. public school)				
Private school				
National school				
Cram school		0.155*		
		(0.092)		
Private teacher	-1.044***		-0.555*	
	(0.279)		(0.304)	
Distance learning	0.380**		0.668***	
	(0.193)		(0.181)	
Lessons related with academic subjects	0.631*			
	(0.373)			
Hours of study during weekdays			0.100	
			(0.063)	
Hours of study during weekends	0.184***		0.0543	
	(0.026)		(0.035)	
Size of city	-0.00247**	0.00126*		
	(0.001)	(0.001)		
Constant		2.856***		4.079***
		(0.529)		(0.394)
Observations	940	940	861	861

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 1 = 5791 and for Model 2 = 4894.

Conclusion

This dissertation explores factors that influence children's education. The first chapter analyses the relationships between schools and parental involvement. It finds that the effective type of informative school outreach differs between elementary and middle school: for the former, informing about school increase parental involvement, while for latter informing about children's learning progress have the same effect. The second chapter analyses the relationships between parental involvement and achievement by comparing the effects of parental involvement across three criteria: elementary and middle school (school level), male and female (gender), and math and science (subject). Findings revealed that parental involvement influences children's education positively regardless of school levels, subjects, and gender. It also shows that monitoring types of involvement are more significantly associated with elementary school than middle school. Since the first and the second chapter use the same data and the same measures of parental involvement, by looking at their results altogether it is possible to have a general view of the linear flow of influence: school influences parents which, in turn, influence children. Finally, the third chapter investigated the effects of maternal and paternal involvement on adolescents' achievement. It finds that not only mothers but also fathers have a significant influence on adolescents' education.

There are some limitations mentioned in each chapter and analysis using panel data is needed for future research. Nevertheless, by controlling for SES, this dissertation provides important information to improve children's education. The first chapter shows the importance of parent-school relationship and suggests that schools can increase the frequency of parental involvement by implementing strategies according to the school level. For example, elementary school can increase frequency of informing parents about the school (e.g., about the educational goals and pedagogic principles of the school) and middle school can increase frequency of informing parents about learning progress of children to increase parental

involvement.

The second and the third chapter suggest specific areas in which policymakers and schools could develop policies to maximize parental involvement. For example, schools can provide seminars for parents in order to encourage parent-child discussion about study and monitoring. Middle schools can guide them on how they can help their children in planning for high school entrance exams and may also suggest parents to discuss not only about study but also about society and news to enhance adolescents' educational aspiration.

The government should address the importance of both maternal and paternal involvement for children's education. Public policies designed to increase the time that working parents spend time with their children can be useful as well.

Appendices

Appendix A Appendix to Chapter 2

Table A. 1 Correlation for the Variables of Parental Involvement

Fourth grade males

	Ask	Talk	Time	Check
Ask	1			
Talk	0.5223	1		
Time	0.3772	0.3331	1	
Check	0.279	0.2938	0.4266	1

	Communicating	Monitoring
Communicating	1	
Monitoring	0.4357	1

Fourth grade females

	Ask	Talk	Time	Check
Ask	1			
Talk	0.5489	1		
Time	0.3787	0.3519	1	
Check	0.293	0.2895	0.4925	1

	Communicating	Monitoring
Communicating	1	
Monitoring	0.4317	1

Eighth grade males

	Ask	Talk	Time	Check
Ask	1			
Talk	0.5969	1		
Time	0.3662	0.3836	1	
Check	0.3454	0.3437	0.6698	1

	Communicating	Monitoring
Communicating	1	
Monitoring	0.4406	1

Eighth grade females

	Ask	Talk	Time	Check
Ask	1			
Talk	0.6248	1		
Time	0.4156	0.3844	1	
Check	0.3566	0.3365	0.7309	1

	Communicating	Monitoring
Communicating	1	
Monitoring	0.4454	1

Table A. 2 The Paths of the Parental Involvement that Changed Significance When Estimating Models with All the Variables

Variables	Significance of the final model	Significance of the model with all variables
4th Male		
Check → Mathematics achievement (+)	5%	10%
8th Male		
Monitoring → Science achievement (-)	10%	5%

Note: The table shows the paths of parental involvement that had changes at the level which they are significant. Except for the two paths shown in the table above, results of estimations using all the control variables did not differ from the final results. Estimation results are presented in Appendix A from Table A.3 to Table A.10. In the cases that full model estimations failed to converge, some variables had to be dropped.

Table A. 3 Results for Fourth Grade with All the Control Variables (Male: Mathematics)

VARIABLES	Male									
	Model 1a						Model 2a			
	Achievement	Attitude	Ask	Time	Check	Talk	Achievement	Attitude	Communicating	Monitoring
Ask	0.360	0.0365								
	(1.602)	(0.028)								
Talk	-4.951***	0.0872***								
	(1.697)	(0.028)								
Time	-0.156	0.0437**								
	(1.374)	(0.021)								
Check	2.551*	-0.00850								
	(1.419)	(0.021)								
Communicating							-3.634***	0.0926***		
							(1.188)	(0.021)		
Monitoring							2.149*	0.0301*		
							(1.281)	(0.018)		
Mathematics attitude	19.47***						19.92***			
	(1.709)						(1.652)			
Possessions at home	4.296***	0.0599***	0.213***	0.138***	0.0956***	0.188***	4.026***	0.0603***	0.157***	0.0853***
	(1.176)	(0.016)	(0.030)	(0.028)	(0.033)	(0.028)	(1.174)	(0.017)	(0.019)	(0.019)
Possessions at home11	-14.85**	-0.0389	0.115	0.00326	-0.261	0.124	-14.81**	-0.0350	0.0577	-0.0954
	(6.177)	(0.094)	(0.207)	(0.227)	(0.203)	(0.171)	(6.113)	(0.094)	(0.106)	(0.130)
Number of books at home	14.34***	0.0312	0.109**	0.122***	0.122**	0.0735	14.30***	0.0303	0.0668**	0.0901***
	(1.617)	(0.026)	(0.045)	(0.046)	(0.049)	(0.051)	(1.623)	(0.026)	(0.030)	(0.029)
Children born between January 1 and April 1	-16.68***	0.0879*					-16.29***	0.0880*		
	(3.530)	(0.052)					(3.518)	(0.053)		
Experiences of being bullied		-0.0672***						-0.0699***		
		(0.023)						(0.023)		
Total enrolment of students (in hundreds)	-0.0142	0.0367**					0.466	0.0373**		
	(1.312)	(0.015)					(0.789)	(0.015)		
Location of school	2.942	-0.0695*					3.836*	-0.0704*		
	(2.443)	(0.036)					(2.033)	(0.037)		
Income level of school area	12.16***	-0.115*					11.23***	-0.114		
	(4.349)	(0.069)					(4.150)	(0.069)		
Class size	0.365	-0.0183***					0.130	-0.0184***		
	(0.514)	(0.006)					(0.390)	(0.006)		
% of economically disadvantaged students	0.302	-0.0715					-2.496	-0.0713		
	(3.154)	(0.057)					(2.666)	(0.058)		
Random intercept of school	1						1			
	(0)						(0)			
Constant	483.3***	-0.0113					487.9***	0.397	-1.602***	-0.921***
	(20.570)	(0.299)					(14.270)	(0.313)	(0.144)	(0.131)
Observations	1849	1849	1849	1849	1849	1849	1849	1849	1849	1849

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 1a = 126356 and for Model 2a = 105220.

Table A. 4 Results for Fourth Grade with All the Control Variables (Female: Mathematics)

VARIABLES	Female							
	Model 3a						Model 4a	
	Achievement	Attitude	Ask	Time	Check	Talk	Achievement	Attitude
Ask	-3.143*	0.0532*						
	(1.747)	(0.029)						
Talk	-3.204*	0.128***						
	(1.776)	(0.028)						
Time	1.527	0.0348*						
	(1.431)	(0.020)						
Check	2.913**	-0.0127						
	(1.375)	(0.021)						
Communicating							-4.605***	0.134***
							(1.317)	(0.023)
Monitoring							3.840***	0.0179
							(1.294)	(0.019)
Mathematics attitude	17.33***						17.75***	
	(1.724)						(1.738)	
Possessions at home	3.685***	0.0509***	0.189***	0.149***	0.104***	0.124***	3.689***	0.0503***
	(0.971)	(0.015)	(0.030)	(0.029)	(0.033)	(0.029)	(0.992)	(0.015)
Possessions at home11	-5.999	-0.120	0.106	0.367	0.0436	0.466**	-7.526	-0.110
	(5.667)	(0.110)	(0.229)	(0.240)	(0.233)	(0.219)	(5.774)	(0.110)
Number of books at home	13.96***	0.0788***	0.0893*	0.172***	0.124**	0.130***	13.74***	0.0805***
	(1.734)	(0.026)	(0.051)	(0.051)	(0.050)	(0.049)	(1.745)	(0.026)
Children born between January 1 and April 1	-16.25***	-0.00451					-16.04***	-0.00666
	(3.352)	(0.045)					(3.326)	(0.046)
Experiences of being bullied		-0.149***						-0.150***
		(0.029)						(0.029)
Total enrolment of students (in hundreds)	-0.469	-0.00683					1.184	-0.00595
	(0.953)	(0.017)					(0.866)	(0.017)
Location of school	2.119	-0.0101					2.738	-0.0143
	(2.674)	(0.036)					(1.989)	(0.035)
Income level of school area	12.93**	0.00907					10.23***	0.0125
	(6.527)	(0.066)					(3.796)	(0.065)
Class size	0.903**	-0.00139					0.463	-0.00207
	(0.453)	(0.007)					(0.329)	(0.007)
% of economically disadvantaged students	4.291	-0.0682					1.529	-0.0631
	(4.461)	(0.045)					(2.618)	(0.045)
Random intercept of school	1						1	
	(0)						(0)	
Constant	470.8***	-1.113***					478.3***	-0.563**
	(21.070)	(0.267)					(16.000)	(0.264)
Observations	1,884	1,884	1,884	1,884	1,884	1,884	1,884	1,884

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 3a = 128190 and for Model 4a = 72832.

Table A. 5 Results for Fourth Grade with All the Control Variables (Male: Science)

VARIABLES	Male									
	Model 5a						Model 6a			
	Achievement	Attitude	Ask	Time	Check	Talk	Achievement	Attitude	Communicating	Monitoring
Ask	0.674	-0.00324								
	(1.466)	(0.026)								
Talk	-4.268***	0.0634**								
	(1.493)	(0.027)								
Time	1.824	0.0526**								
	(1.148)	(0.022)								
Check	0.756	0.0296								
	(1.201)	(0.021)								
Communicating							-2.422**	0.0447**		
							(1.078)	(0.020)		
Monitoring							2.248**	0.0701***		
							(1.147)	(0.021)		
Science attitude	5.810***						5.941***			
	(1.288)						(1.295)			
Possessions at home	3.588***	0.0478***	0.213***	0.138***	0.0956***	0.188***	3.455***	0.0478***	0.157***	0.0853***
	(0.973)	(0.016)	(0.030)	(0.028)	(0.033)	(0.028)	(0.981)	(0.016)	(0.019)	(0.019)
Possessions at home11	-13.37**	-0.0927	0.115	0.00328	-0.261	0.124	-13.27**	-0.0910	0.0577	-0.0954
	(5.782)	(0.099)	(0.207)	(0.227)	(0.203)	(0.171)	(5.654)	(0.099)	(0.106)	(0.130)
Number of books at home	14.85***	0.0438*	0.109**	0.122***	0.122**	0.0735	14.89***	0.0430*	0.0668**	0.0901***
	(1.441)	(0.024)	(0.045)	(0.046)	(0.049)	(0.051)	(1.441)	(0.024)	(0.030)	(0.029)
Children born between January 1 and April 1	-22.20***	0.112**					-22.19***	0.113**		
	(2.998)	(0.051)					(3.007)	(0.051)		
Experiences of being bullied		-0.0215						-0.0238		
		(0.023)						(0.023)		
Total enrolment of students (in hundreds)	0.217	0.0293**					0.825	0.0298**		
	(0.991)	(0.014)					(0.681)	(0.014)		
Location of school	1.882	0.00792					2.235	0.00655		
	(1.904)	(0.031)					(1.736)	(0.031)		
Income level of school area	10.08***	-0.158***					7.080**	-0.157***		
	(3.428)	(0.057)					(3.352)	(0.056)		
Class size	-0.0417	-0.0144**					-0.183	-0.0146**		
	(0.395)	(0.006)					(0.302)	(0.007)		
% of economically disadvantaged students	-0.0776	-0.100*					-3.505	-0.0994*		
	(2.309)	(0.059)					(2.142)	(0.059)		
Random intercept of school	1						1			
	(0)						(0)			
Constant	480.3***	-0.0623					488.8***	0.315	-1.602***	-0.921***
	(14.230)	(0.281)					(11.920)	(0.273)	(0.144)	(0.131)
Observations	1849	1849	1849	1849	1849	1849	1849	1849	1849	1849

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 5a = 234199 and for Model 6a = 199969.

Table A. 6 Results for Fourth Grade with All the Control Variables (Female: Science)

VARIABLES	Female								
	Model 7a						Model 8a		
	Achievement	Attitude	Ask	Time	Check	Talk	Achievement	Attitude	Communicating
Ask	-0.899	-0.0326							
	(1.474)	(0.026)							
Talk	-3.518**	0.0879***							
	(1.462)	(0.025)							
Time	2.859**	0.0164							
	(1.203)	(0.020)							
Check	0.699	0.0420**							
	(1.238)	(0.020)							
Communicating							-3.184***	0.0392*	
							(1.101)	(0.022)	
Monitoring							3.206***	0.0488**	
							(1.187)	(0.020)	
Science attitude	6.820***						6.986***		
	(1.245)						(1.305)		
Possessions at home	2.998***	0.0267*	0.195***	0.168***	0.106***	0.147***	3.066***	0.0244*	0.145***
	(0.886)	(0.014)	(0.028)	(0.029)	(0.029)	(0.028)	(0.884)	(0.014)	(0.016)
Possessions at home11	-1.309	0.196**					-2.096	0.202**	
	(5.137)	(0.091)					(5.310)	(0.091)	
Number of books at home	13.77***	0.0604***	0.0906*	0.176***	0.125**	0.133***	13.62***	0.0612***	
	(1.436)	(0.021)	(0.050)	(0.052)	(0.050)	(0.049)	(1.422)	(0.021)	
Children born between January 1 and April 1	-21.68***	0.0670					-21.73***	0.0653	
	(2.751)	(0.051)					(2.750)	(0.052)	
Experiences of being bullied		-0.0799**						-0.0801**	
		(0.033)						(0.033)	
Total enrolment of students (in hundreds)	-0.637	0.0211					-0.671	0.0227	
	(0.792)	(0.019)					(1.114)	(0.019)	
Location of school	2.459	-0.000224					2.672	3.19e-05	
	(2.135)	(0.037)					(1.868)	(0.038)	
Income level of school area	8.256	-0.123					6.137*	-0.120	
	(5.134)	(0.085)					(3.566)	(0.085)	
Class size	0.410	-0.00232					0.591*	-0.00306	
	(0.330)	(0.007)					(0.331)	(0.007)	
% of economically disadvantaged students	-0.382	-0.0447					-2.654	-0.0416	
	(3.812)	(0.045)					(2.406)	(0.045)	
Random intercept of school	1						1		
	(0)						(0)		
Constant	476.6***	-0.578*					474.6***	-0.234	-0.987***
	(16.560)	(0.338)					(12.640)	(0.323)	(0.140)
	1,884	1,884	1,884	1,884	1,884	1,884	1,884	1,884	1,884

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 7a = 238375 and for Model 8a = 204006.

Table A. 7 Results for Eighth Grade with All the Control Variables (Male: Mathematics)

	Male												
	Model 9a							Model 10a					
VARIABLES	Achievement	Attitude	Aspiration	Ask	Time	Check	Talk	Achievement	Attitude	Aspiration	Communicating	Monitoring	
Ask	2.571	-0.00819	0.108										
	(2.259)	(0.035)	(0.079)										
Talk	1.280	0.104***	0.233***										
	(2.525)	(0.030)	(0.070)										
Time	-1.221	0.0208	0.0798										
	(2.012)	(0.033)	(0.068)										
Check	-1.821	0.0665**	-0.0272										
	(1.834)	(0.030)	(0.076)										
Communicating								2.605	0.0650***	0.236***			
								(1.668)	(0.021)	(0.048)			
Monitoring								-2.319*	0.0722***	0.0405			
								(1.333)	(0.023)	(0.050)			
Mathematics attitude	25.04***							24.97***					
	(1.623)							(1.652)					
Aspiration	31.32***							31.30***					
	(2.331)							(2.294)					
Possessions at home	1.864	0.0935***	0.250***	0.144***	0.153***	0.142***	0.0599	2.023*	0.0922***	0.252***	0.107***	0.0654**	
	(1.243)	(0.016)	(0.037)	(0.037)	(0.036)	(0.035)	(0.041)	(1.228)	(0.015)	(0.036)	(0.023)	(0.028)	
Possessions at home11	-0.629	-0.0199	0.184	0.0543	0.290	-0.152	0.213	-1.001	-0.0210	0.160	0.145	0.0769	
	(10.720)	(0.140)	(0.372)	(0.220)	(0.253)	(0.234)	(0.294)	(10.940)	(0.139)	(0.374)	(0.140)	(0.186)	
Number of books at home	6.975***	0.000751	0.139***	0.135***	0.165***	0.150***	0.0987***	7.064***	-0.000863	0.139***	0.107***	0.0989***	
	(1.577)	(0.021)	(0.047)	(0.048)	(0.045)	(0.040)	(0.038)	(1.558)	(0.021)	(0.047)	(0.031)	(0.026)	
Ref: High school or below													
Mother: Higher than University	0.607	-0.00496	0.707***	-0.0666	0.295**	0.241*	0.403***	0.744	-0.0125	0.687***	0.0754	0.227**	
	(5.476)	(0.081)	(0.218)	(0.144)	(0.144)	(0.135)	(0.153)	(5.365)	(0.080)	(0.217)	(0.094)	(0.102)	
Mother: Junior college	10.11*	0.0635	-0.256	0.132	0.0380	-0.0717	-0.0804	9.806*	0.0649	-0.251	0.0692	-0.0363	
	(5.699)	(0.078)	(0.216)	(0.150)	(0.150)	(0.165)	(0.163)	(5.680)	(0.078)	(0.216)	(0.100)	(0.117)	
Mother: Unknown	-8.892*	0.00324	0.268	-0.310*	-0.0343	0.417**	0.333**	-8.630*	-0.00535	0.260	-0.140	0.283***	
	(4.825)	(0.085)	(0.165)	(0.159)	(0.146)	(0.168)	(0.156)	(4.837)	(0.085)	(0.167)	(0.099)	(0.107)	
Father: Higher than University	0.545	0.176**	1.143***	0.240*	0.212	-0.0120	0.0419	-18.31**	-0.108	-0.775***	-0.142	0.00708	
	(4.679)	(0.073)	(0.186)	(0.133)	(0.135)	(0.137)	(0.126)	(7.270)	(0.093)	(0.222)	(0.142)	(0.136)	
Father: Junior college	-19.18***	-0.105	-0.768***	-0.247	-0.0762	-0.0455	0.0946	0.510	0.179**	1.145***	0.178**	0.0351	
	(7.363)	(0.094)	(0.224)	(0.189)	(0.237)	(0.206)	(0.201)	(4.672)	(0.073)	(0.185)	(0.091)	(0.090)	
Father: Unknown	-5.267	0.111	0.339*	-0.0696	-0.163	-0.448***	-0.177	-5.115	0.117	0.336*	-0.0788	-0.220**	
	(4.838)	(0.075)	(0.177)	(0.154)	(0.153)	(0.161)	(0.137)	(4.835)	(0.075)	(0.179)	(0.102)	(0.098)	
Children born between January 1 and April 1	-14.37***	-0.0129	-0.107					-13.78***	-0.0143	-0.114			
	(4.330)	(0.048)	(0.119)					(4.372)	(0.049)	(0.117)			
Experiences of being bullied		0.0346							0.0348				
		(0.029)							(0.029)				
Total enrolment of students (in hundreds)	-0.856	-0.0182	-0.0211					-1.341	-0.0187	-0.0202			
	(1.305)	(0.017)	(0.029)					(1.299)	(0.017)	(0.029)			
Location of school	4.249	0.0355	0.165*					5.023	0.0385	0.170**			
	(3.422)	(0.037)	(0.086)					(3.425)	(0.037)	(0.085)			
Private or national school	36.96***	0.221*	0.834***					32.75***	0.227**	0.846***			
	(9.954)	(0.113)	(0.231)					(11.710)	(0.111)	(0.228)			
School-P	11.30**	-0.0247	0.153					14.72**	-0.0279	0.148			
	(5.360)	(0.053)	(0.106)					(6.016)	(0.053)	(0.105)			
Income level of school area	3.195	0.113	0.140					-0.0348	0.116	0.144			
	(4.744)	(0.085)	(0.141)					(5.340)	(0.086)	(0.140)			
% of economically disadvantaged students	1.554	0.0345	-0.0157					0.682	0.0357	-0.0130			
	(3.941)	(0.056)	(0.103)					(3.910)	(0.056)	(0.102)			
Class size	-0.377	-0.0106	-0.0166					-0.191	-0.0113	-0.0170			
	(0.648)	(0.007)	(0.013)					(0.695)	(0.007)	(0.013)			
Random intercept of school	1							1					
	(0)							(0)					
Constant	378.0***	-1.035**						356.1***	-0.564		-1.269***	-0.853***	
	(45.310)	(0.468)						(49.280)	(0.473)		(0.163)	(0.196)	
	1,789	1,789	1,789	1,789	1,789	1,789	1,789	1,789	1,789	1,789	1,789	1,789	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 9a = 124803 and for Model 10a = 103708.

Table A. 8 Results for Eighth Grade with All the Control Variables (Female: Mathematics)

	Female												
	Model 11a							Model 12a					
VARIABLES	Achievement	Attitude	Aspiration	Ask	Time	Check	Talk	Achievement	Attitude	Aspiration	Communicating	Monitoring	
Ask	-3.226	0.00832	0.0212										
	(2.142)	(0.035)	(0.070)										
Talk	2.050	0.159***	0.133*										
	(2.247)	(0.036)	(0.073)										
Time	2.494	0.00279	0.0813										
	(2.101)	(0.028)	(0.064)										
Check	-4.586**	-0.000645	-0.0964										
	(1.931)	(0.027)	(0.065)										
Communicating								-0.732	0.113***	0.110**			
								(1.182)	(0.025)	(0.044)			
Monitoring								-1.842	-0.000335	-0.0182			
								(1.236)	(0.021)	(0.047)			
Mathematics attitude	24.93***							25.28***					
	(1.508)							(1.535)					
Aspiration	28.96***							29.23***					
	(2.218)							(2.234)					
Possessions at home	4.800***	0.0762***	0.238***	0.157***	0.170***	0.157***	0.0652*	4.801***	0.0770***	0.241***	0.118***	0.0789***	
	(1.301)	(0.015)	(0.033)	(0.040)	(0.044)	(0.041)	(0.038)	(1.310)	(0.015)	(0.033)	(0.027)	(0.027)	
Possessions at home11	4.006	-0.0582	-0.501	-0.160	-0.209	-0.0203	0.163	2.936	-0.0582	-0.504	-0.118	0.0858	
	(7.849)	(0.145)	(0.399)	(0.288)	(0.240)	(0.309)	(0.304)	(7.915)	(0.147)	(0.397)	(0.173)	(0.226)	
Number of books at home	10.09***	0.0415*	0.155***	0.143***	0.102**	0.0534	0.0977**	9.650***	0.0421*	0.151***	0.0857***	0.0613**	
	(1.439)	(0.023)	(0.050)	(0.038)	(0.042)	(0.043)	(0.043)	(1.419)	(0.023)	(0.050)	(0.025)	(0.029)	
Ref: High school or below													
Mother: Higher than University	0.924	0.127*	1.322***	0.177	0.153	0.0957	0.0742	1.508	0.132*	1.320***	0.114	0.0680	
	(4.697)	(0.075)	(0.227)	(0.154)	(0.141)	(0.143)	(0.167)	(4.695)	(0.074)	(0.227)	(0.099)	(0.108)	
Mother: Junior college	4.851	-0.0734	-1.030***	-0.217	-0.126	-0.173	-0.153	4.398	-0.0810	-1.028***	-0.108	-0.119	
	(4.441)	(0.078)	(0.219)	(0.149)	(0.158)	(0.134)	(0.172)	(4.400)	(0.078)	(0.217)	(0.100)	(0.106)	
Mother: Unknown	2.945	0.159**	0.549***	-0.449**	-0.352**	-0.0536	0.0823	2.892	0.155**	0.540***	-0.294**	0.00421	
	(5.682)	(0.076)	(0.192)	(0.180)	(0.179)	(0.159)	(0.154)	(5.675)	(0.076)	(0.191)	(0.120)	(0.111)	
Father: Higher than University	13.73***	0.112	1.112***	-0.00687	0.112	0.109	0.0539	13.38***	0.111	1.115***	0.0451	0.0609	
	(4.737)	(0.087)	(0.157)	(0.115)	(0.123)	(0.135)	(0.135)	(4.754)	(0.086)	(0.157)	(0.077)	(0.097)	
Father: Junior college	-17.06***	0.148	-0.705***	0.281	0.156	0.118	0.147	-16.46***	0.152	-0.704***	0.147	0.0906	
	(5.410)	(0.108)	(0.207)	(0.176)	(0.188)	(0.176)	(0.178)	(5.419)	(0.107)	(0.208)	(0.121)	(0.130)	
Father: Unknown	-2.040	-0.0401	0.262	-0.151	0.0755	-0.0537	-0.0720	-2.640	-0.0466	0.259	-0.0267	-0.0406	
	(5.304)	(0.081)	(0.176)	(0.139)	(0.141)	(0.130)	(0.136)	(5.302)	(0.079)	(0.174)	(0.088)	(0.094)	
Children born between January 1 and April 1	-7.164*	-0.0299	-0.268**					-7.033*	-0.0277	-0.267**			
	(3.949)	(0.057)	(0.119)					(4.006)	(0.057)	(0.119)			
Experiences of being bullied		-0.0195							-0.0197				
		(0.030)							(0.031)				
Total enrolment of students (in hundreds)	0.0557	-0.00194	0.0133					0.667	0.000167	0.0151			
	(1.279)	(0.014)	(0.034)					(1.316)	(0.014)	(0.034)			
Location of school	0.156	0.0168	-0.0391					-1.855		-0.0416			
	(2.947)	(0.039)	(0.076)					(3.056)		(0.076)			
Private or national school	17.27	0.0759	1.620***					13.80	0.0786	1.621***			
	(10.760)	(0.137)	(0.274)					(11.920)	(0.133)	(0.277)			
School-P	1.485	-0.0998**	0.170					1.577	-0.0973**	0.169			
	(3.535)	(0.050)	(0.118)					(3.871)	(0.047)	(0.118)			
Income level of school area	13.74***	0.0701	0.338**					13.36**	0.0605	0.331**			
	(5.265)	(0.076)	(0.148)					(5.698)	(0.075)	(0.150)			
% of economically disadvantaged students	4.791	0.0140	0.0911					4.263	0.0154	0.0912			
	(4.011)	(0.049)	(0.100)					(4.055)	(0.047)	(0.100)			
Class size	0.756	-0.0108	-0.0185					0.866	-0.0107	-0.0188			
	(0.773)	(0.010)	(0.018)					(0.811)	(0.010)	(0.018)			
Random intercept of school	1							1					
	(0)							(0)					
Constant	364.9***	-0.362						357.4***	0.0875		-0.961***	-0.795***	
	(35.310)	(0.443)						(37.980)	(0.427)		(0.201)	(0.185)	
Random intercept of school	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 11a = 127038 and for Model 12a = 88858.

Table A. 9 Results for Eighth Grade with All the Control Variables (Male: Science)

	Male												
	Model 13a							Model 14a					
VARIABLES	Achievement	Attitude	Aspiration	Ask	Time	Check	Talk	Achievement	Attitude	Aspiration	Communicating	Monitoring
Ask	0.619	0.0140	0.108									
	(2.337)	(0.034)	(0.079)									
Talk	0.325	0.122***	0.233***									
	(2.253)	(0.035)	(0.070)									
Time	0.586	0.0390	0.0798									
	(1.811)	(0.030)	(0.068)									
Check	-0.133	0.00605	-0.0272									
	(1.804)	(0.029)	(0.076)									
Communicating								0.516	0.0935***	0.236***		
								(1.464)	(0.022)	(0.048)		
Monitoring								0.325	0.0367*	0.0405		
								(1.267)	(0.022)	(0.050)		
Science attitude	22.92***							23.02***				
	(1.706)							(1.727)				
Aspiration	26.78***							26.86***				
	(2.049)							(2.013)				
Possessions at home	1.187	0.0442**	0.250***	0.147***	0.168***	0.133***	0.0712*	1.321	0.0447***	0.252***	0.107***	0.0654**
	(1.175)	(0.017)	(0.037)	(0.033)	(0.033)	(0.032)	(0.037)	(1.164)	(0.017)	(0.036)	(0.023)	(0.028)
Possessions at home11	5.599	0.120	0.184					5.054	0.111	0.160	0.145	0.0769
	(9.800)	(0.165)	(0.372)					(9.989)	(0.166)	(0.374)	(0.140)	(0.186)
Number of books at home	8.969***	0.0503**	0.139***	0.135***	0.164***	0.150***	0.0983***	9.098***	0.0501**	0.139***	0.107***	0.0989***
	(1.384)	(0.020)	(0.047)	(0.048)	(0.045)	(0.040)	(0.038)	(1.368)	(0.020)	(0.047)	(0.031)	(0.026)
Ref: High school or below												
Mother: Higher than University	-0.870	-0.0233	0.707***	-0.0658	0.301**	0.237*	0.406***	-0.725	-0.0355	0.687***	0.0754	0.227**
	(4.306)	(0.071)	(0.218)	(0.144)	(0.143)	(0.135)	(0.154)	(4.234)	(0.071)	(0.217)	(0.094)	(0.102)
Mother: Junior college	12.60***	0.0809	-0.256	0.131	0.0338	-0.0683	-0.0843	12.39***	0.0838	-0.251	0.0692	-0.0363
	(4.710)	(0.081)	(0.216)	(0.150)	(0.150)	(0.167)	(0.164)	(4.664)	(0.081)	(0.216)	(0.100)	(0.117)
Mother: Unknown	-9.590**	-0.0337	0.268	-0.309*	-0.0293	0.414**	0.338**	-9.449**	-0.0397	0.260	-0.140	0.283***
	(4.552)	(0.077)	(0.165)	(0.160)	(0.146)	(0.168)	(0.155)	(4.532)	(0.077)	(0.167)	(0.099)	(0.107)
Father: Higher than University	-0.305	0.140**	1.143***	0.239*	0.205	-0.00972	0.0401	-0.200	0.142**	1.145***	0.178**	0.0351
	(4.359)	(0.066)	(0.186)	(0.133)	(0.136)	(0.137)	(0.126)	(4.350)	(0.066)	(0.185)	(0.091)	(0.090)
Father: Junior college	-6.517	-0.0155	-0.768***	-0.245	-0.0658	-0.0515	0.105	-5.627	-0.0224	-0.775***	-0.142	0.00708
	(6.249)	(0.081)	(0.224)	(0.190)	(0.238)	(0.209)	(0.200)	(6.227)	(0.082)	(0.222)	(0.142)	(0.136)
Father: Unknown	-0.977	0.107	0.339*	-0.0699	-0.165	-0.447***	-0.178	-0.996	0.108	0.336*	-0.0788	-0.220**
	(4.473)	(0.070)	(0.177)	(0.154)	(0.154)	(0.161)	(0.136)	(4.439)	(0.070)	(0.179)	(0.102)	(0.098)
Children born between January 1and April 1	-11.22***	0.0585	-0.107					-10.71***	0.0529	-0.114		
	(3.587)	(0.048)	(0.119)					(3.612)	(0.048)	(0.117)		
Experiences of being bullied		0.000439							-0.000626			
		(0.026)							(0.026)			
Total enrolment of students (in hundreds)	-0.526	-0.0152	-0.0211					-0.796	-0.0150	-0.0202		
	(1.195)	(0.021)	(0.029)					(1.209)	(0.021)	(0.029)		
Location of school	3.779	-0.0357	0.165*					4.962*	-0.0325	0.170**		
	(2.510)	(0.043)	(0.086)					(2.546)	(0.043)	(0.085)		
Private or national school	16.82*	0.206*	0.834***					10.74	0.213*	0.846***		
	(10.030)	(0.118)	(0.231)					(11.120)	(0.117)	(0.228)		
School-P	9.278**	-0.0980	0.153					11.98***	-0.102	0.148		
	(4.333)	(0.063)	(0.106)					(4.535)	(0.063)	(0.105)		
Income level of school area	0.158	0.0265	0.140					-2.694	0.0287	0.144		
	(4.153)	(0.078)	(0.141)					(4.254)	(0.077)	(0.140)		
% of economically disadvantaged students	-0.819	0.00561	-0.0157					-1.238	0.00677	-0.0130		
	(3.756)	(0.054)	(0.103)					(3.661)	(0.055)	(0.102)		
Class size	-0.473	-0.00740	-0.0166					-0.344	-0.00794	-0.0170		
	(0.619)	(0.008)	(0.013)					(0.668)	(0.008)	(0.013)		
Random intercept of school	1							1				
	(0)							(0)				
Constant	402.2***	0.0577						383.5***	0.510		-1.269***	-0.853***
	(38.050)	(0.603)						(39.590)	(0.587)		(0.163)	(0.196)
Random intercept of school	1,789	1,789	1,789	1,789	1,789	1,789	1,789	1,789	1,789	1,789	1,789	1,789

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 13a = 232999 and for Model 14a = 198764.

Table A. 10 Results for Eighth Grade with All the Control Variables (Female: Science)

	Female											
	Model 15a							Model 16a				
VARIABLES	Achievement	Attitude	Aspiration	Ask	Time	Check	Talk	Achievement	Attitude	Aspiration	Communicating	Monitoring
Ask	-2.859	-0.0564*	0.0212									
	(1.869)	(0.031)	(0.070)									
Talk	0.185	0.175***	0.133*									
	(2.042)	(0.034)	(0.073)									
Time	2.791	0.0201	0.0813									
	(1.902)	(0.029)	(0.064)									
Check	-2.445*	0.0624**	-0.0964									
	(1.478)	(0.027)	(0.065)									
Communicating								-1.772	0.0766***	0.110**		
								(1.174)	(0.021)	(0.044)		
Monitoring								0.178	0.0647***	-0.0182		
								(1.206)	(0.018)	(0.047)		
Science attitude	20.41***							20.36***				
	(1.482)							(1.477)				
Aspiration	28.57***							28.78***				
	(2.153)							(2.137)				
Possessions at home	4.020***	0.0223	0.238***	0.157***	0.170***	0.157***	0.0652*	4.111***	0.0214	0.241***	0.113***	0.0820***
	(1.182)	(0.019)	(0.033)	(0.040)	(0.044)	(0.041)	(0.038)	(1.196)	(0.019)	(0.033)	(0.025)	(0.027)
Possessions at home11	3.846	-0.0381	-0.501	-0.160	-0.209	-0.0202	0.163	3.160	-0.0344	-0.504		
	(7.881)	(0.136)	(0.399)	(0.288)	(0.240)	(0.309)	(0.304)	(7.931)	(0.137)	(0.397)		
Number of books at home	9.679***	0.121***	0.155***	0.143***	0.102**	0.0534	0.0977**	9.365***	0.123***	0.151***	0.0857***	0.0613**
	(1.352)	(0.022)	(0.050)	(0.038)	(0.042)	(0.043)	(0.043)	(1.340)	(0.022)	(0.050)	(0.025)	(0.029)
Ref: High school or below												
Mother: Higher than University	3.200	0.0985	1.322***	0.177	0.153	0.0957	0.0742	3.745	0.106	1.320***	0.114	0.0679
	(4.714)	(0.077)	(0.227)	(0.154)	(0.141)	(0.143)	(0.167)	(4.715)	(0.077)	(0.227)	(0.099)	(0.108)
Mother: Junior college	5.796	-0.0120	-1.030***	-0.217	-0.126	-0.173	-0.153	5.403	-0.0218	-1.028***	-0.108	-0.119
	(4.195)	(0.069)	(0.219)	(0.149)	(0.158)	(0.134)	(0.172)	(4.219)	(0.069)	(0.217)	(0.101)	(0.106)
Mother: Unknown	3.173	0.136	0.549***	-0.449**	-0.352**	-0.0536	0.0823	2.989	0.133	0.540***	-0.292**	0.00291
	(4.430)	(0.086)	(0.192)	(0.180)	(0.179)	(0.159)	(0.154)	(4.415)	(0.086)	(0.191)	(0.119)	(0.111)
Father: Higher than University	4.197	-0.000805	1.112***	-0.00687	0.112	0.109	0.0539	4.216	-0.00610	1.115***	0.0446	0.0613
	(3.969)	(0.062)	(0.157)	(0.115)	(0.123)	(0.135)	(0.135)	(3.979)	(0.061)	(0.157)	(0.077)	(0.097)
Father: Junior college	1.907	0.0359	-0.705***	0.281	0.156	0.118	0.147	2.317	0.0422	-0.704***	0.147	0.0903
	(5.882)	(0.102)	(0.207)	(0.176)	(0.188)	(0.176)	(0.178)	(5.909)	(0.101)	(0.208)	(0.121)	(0.130)
Father: Unknown	-1.415	-0.0482	0.262	-0.151	0.0755	-0.0537	-0.0720	-1.594	-0.0607	0.259	-0.0273	-0.0402
	(4.706)	(0.081)	(0.176)	(0.139)	(0.141)	(0.130)	(0.136)	(4.692)	(0.081)	(0.174)	(0.088)	(0.094)
Children born between January 1and April 1	-2.596	-0.0836	-0.268**					-2.580	-0.0792	-0.267**		
	(3.210)	(0.051)	(0.119)					(3.233)	(0.051)	(0.119)		
Experiences of being bullied		-0.000103							-0.00185			
		(0.027)							(0.028)			
Total enrolment of students (in hundreds)	0.0946	9.51e-05	0.0133					0.717	0.00168	0.0151		
	(1.116)	(0.017)	(0.034)					(1.159)	(0.018)	(0.034)		
Location of school	0.235	-0.0909**	-0.0391					-0.381	-0.0882*	-0.0416		
	(2.236)	(0.044)	(0.076)					(2.250)	(0.045)	(0.076)		
Private or national school	9.304	-0.0768	1.620***					5.406	-0.0858	1.621***		
	(8.318)	(0.172)	(0.274)					(8.804)	(0.176)	(0.277)		
School-P	1.310	-0.0541	0.170					1.319	-0.0564	0.169		
	(2.923)	(0.069)	(0.118)					(3.124)	(0.071)	(0.118)		
Income level of school area	8.577**	0.0900	0.338**					8.506**	0.0811	0.331**		
	(4.205)	(0.080)	(0.148)					(4.231)	(0.081)	(0.150)		
% of economically disadvantaged students	0.712	0.0584	0.0911					0.784	0.0559	0.0912		
	(3.420)	(0.063)	(0.100)					(3.537)	(0.063)	(0.100)		
Class size	-0.249	0.00475	-0.0185					-0.246	0.00378	-0.0188		
	(0.609)	(0.012)	(0.018)					(0.633)	(0.012)	(0.018)		
Random intercept of school	1							1				
	(0)							(0)				
Constant	407.5***	-0.832						398.8***	-0.282		-0.931***	-0.817***
	(28.420)	(0.622)						(30.380)	(0.629)		(0.187)	(0.185)
	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 15a = 236617 and for Model 16a = 202366.

Appendix B　Appendix to Chapter 3

Table B. 1 The Paths of the Parental Involvement that Changed Significance When Estimating Models with All the Variables

Variables	Significance of the final model	Significance of the model with all variables
Female		
Mother: discussion about study and grade → grade (+)	1%	5%
Male		
Father: discussion about future and life course after graduation → grade (-)	10%	5%
Father: discussion about future and life course after gradutaion → aspiration (+)	5%	10%
Father: discussion about friends → aspiration (-)	1%	Not significant
Maternal aspiration → grade (+)	1%	5%

Note: The table shows the paths of parental involvement that had changes at the level which they are significant. The results of estimations using all the control variables are consistent with the final results except that differences of p-value are found in the paths shown in the table above. Estimation results are presented in Appendix B from Table B.2 to Table B.7.

Table B. 2 Results of GSEM for Males with All the Control Variables

	Model 1b															
Variables	Grade	Aspiration	M1	M2	M3	M4	M5	M6	MA	F1	F2	F3	F4	F5	F6	FA
Adolescents' educational aspiration	0.377***															
	(0.049)															
Discussion																
(M1) Mother: episodes from school	0.325***	0.153*														
	(0.116)	(0.081)														
(M2) Mother: about study and grades	-0.0455	0.0741														
	(0.120)	(0.084)														
(M3) Mother: future and life course after graduation	0.205*	-0.0638														
	(0.110)	(0.077)														
(M4) Mother: about friends	-0.262**	-0.0870														
	(0.104)	(0.071)														
(M5) Mother: about society and news	0.00212	0.0249														
	(0.088)	(0.062)														
(M6) Mother: about hobby and extracurricular activities	0.0295	0.0266														
	(0.093)	(0.065)														
(F1) Father: about episode from school	-0.0594	-0.0841														
	(0.110)	(0.077)														
(F2) Father: about study and grades	0.331***	0.0561														
	(0.108)	(0.075)														
(F3) Father: future and life course after graduation	-0.221**	0.128*														
	(0.106)	(0.074)														
(F4) Father: about friends	0.118	-0.0904														
	(0.104)	(0.072)														
(F5) Father: about society and news	0.0927	0.00936														
	(0.088)	(0.062)														
(F6) Father: about hobby and extracurricular activities	-0.231***	0.0739														
	(0.089)	(0.063)														
(MA) Maternal aspiration	0.160**	0.367***														
	(0.063)	(0.043)														
(FA) Paternal aspiration	0.0801	0.340***														
	(0.057)	(0.040)														
Years of education completed by mother	0.0691	-0.00449	-0.00541	0.0119	-0.00148	-0.0171	0.0323*	0.0345*	0.227***							
	(0.046)	(0.032)	(0.017)	(0.016)	(0.017)	(0.019)	(0.019)	(0.020)	(0.027)							
Years of education completed by father	0.0303	0.0448*								-0.00786	0.0321**	0.0169	-0.00663	0.0561***	0.00157	0.329***
	(0.039)	(0.027)								(0.015)	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)	(0.022)

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B. 3 Results of GSEM for Males with All the Control Variables (Continuous Part from Table B.2)

	Model 1b															
Variables	Grade	Aspiration	M1	M2	M3	M4	M5	M6	MA	F1	F2	F3	F4	F5	F6	FA
Employment status (ref. non-employed)																
Mother: regular employment	-0.195	0.118	-0.150*	-0.0806	-0.0908	-0.142	-0.100	-0.00153	-0.283**							
	(0.193)	(0.137)	(0.085)	(0.080)	(0.085)	(0.094)	(0.097)	(0.099)	(0.135)							
Mother: contractual employment	-0.167	-0.0115	-0.0992	-0.00182	-0.0346	-0.103	-0.137*	-0.0502	0.0295							
	(0.156)	(0.109)	(0.069)	(0.064)	(0.068)	(0.075)	(0.078)	(0.079)	(0.108)							
Mother: other	-0.181	0.0703	0.0293	0.0531	-0.223*	-0.143	-0.0294	0.0702	0.243							
	(0.290)	(0.203)	(0.120)	(0.112)	(0.120)	(0.132)	(0.137)	(0.139)	(0.190)							
Father: regular employment	0.283	0.284								-0.522*	-0.0432	-0.222	-0.272	-0.285	-0.0108	1.062**
	(0.524)	(0.423)								(0.300)	(0.291)	(0.295)	(0.308)	(0.318)	(0.325)	(0.441)
Father: contractual employment	0.512	-0.333								-0.844**	-0.298	-0.547	-0.571	-0.568	-0.402	1.405***
	(0.622)	(0.483)								(0.343)	(0.333)	(0.337)	(0.352)	(0.363)	(0.372)	(0.504)
Father: directors	0.276	0.0671								-0.440	0.0303	-0.0640	-0.144	-0.176	0.0541	1.031**
	(0.580)	(0.457)								(0.325)	(0.316)	(0.319)	(0.334)	(0.344)	(0.352)	(0.477)
Father: other	0.303	0.325								-0.482	0.0203	-0.237	-0.285	-0.0880	0.0963	1.187***
	(0.549)	(0.439)								(0.310)	(0.301)	(0.305)	(0.319)	(0.329)	(0.336)	(0.456)
Household income	4.93e-05	0.000289**	6.79e-05	0.000142**	4.68e-05	5.80e-05	2.28e-05	7.80e-05	0.000907***	4.33e-06	0.000157*	6.56e-05	-9.52e-05	0.000177**	8.82e-05	0.000525***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Father listens to adolescent and gives advice	0.131	0.0155														
	(0.181)	(0.126)														
Mother listens to adolescent and gives advice	-0.128	-0.0962														
	(0.189)	(0.131)														
Relationships of parents	0.144**	0.00294														
	(0.061)	(0.043)														
Number of siblings	0.127	-0.108*														
	(0.086)	(0.060)														
Type of school (ref. public school)																
Private school	-0.325	0.0263														
	(0.229)	(0.150)														
National school	0.224	-0.292														
	(0.517)	(0.383)														
Cram school	-0.183															
	(0.157)															
Private teacher	-1.107***															
	(0.293)															
Distance learning	0.300															
	(0.204)															
Lessons related with academic subjects	0.650*															
	(0.379)															

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B. 4 Results of GSEM for Males with All the Control Variables (Continuous Part from Table B.3)

	Model 1b															
Variables	Grade	Aspiration	M1	M2	M3	M4	M5	M6	MA	F1	F2	F3	F4	F5	F6	FA
Hours of study during weekdays	0.0926															
	(0.064)															
Hours of study during weekends	0.149***															
	(0.034)															
Size of city	-0.00238**	0.00127														
	(0.001)	(0.001)														
Constant		2.650***	3.184***	2.921***	3.124***	3.157***	2.074***	2.205***	11.64***	3.104***	2.209***	2.647***	2.725***	1.778***	2.446***	9.168***
		(0.703)	(0.223)	(0.208)	(0.222)	(0.244)	(0.253)	(0.257)	(0.352)	(0.353)	(0.343)	(0.347)	(0.363)	(0.374)	(0.383)	(0.518)
Observations	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 1b = 42559.

Table B. 5Results of GSEM for Females with All the Control Variables

	Model 2b															
Variables	Grade	Aspiration	M1	M2	M3	M4	M5	M6	MA	F1	F2	F3	F4	F5	F6	FA
Adolescents' educational aspiration	0.382***															
	(0.062)															
Discussion																
(M1) Mother: episodes from school	-0.0147	-0.0123														
	(0.138)	(0.077)														
(M2) Mother: about study and grades	0.334**	0.0422														
	(0.133)	(0.072)														
(M3) Mother: future and life course after graduation	-0.0489	-0.0285														
	(0.125)	(0.068)														
(M4) Mother: about friends	0.0120	0.0160														
	(0.111)	(0.062)														
(M5) Mother: about society and news	-0.00618	-0.00105														
	(0.095)	(0.052)														
(M6) Mother: about hobby and extracurricular activities	0.0548	-0.00835														
	(0.094)	(0.053)														
(F1) Father: about episode from school	-0.117	0.0193														
	(0.115)	(0.064)														
(F2) Father: about study and grades	0.372***	-0.0450														
	(0.116)	(0.064)														
(F3) Father: future and life course after graduation	-0.239**	0.0484														
	(0.116)	(0.065)														
(F4) Father: about friends	-0.0518	-0.0779														
	(0.104)	(0.058)														
(F5) Father: about society and news	0.131	0.169***														
	(0.090)	(0.049)														
(F6) Father: about hobby and extracurricular activities	-0.166*	-0.0171														
	(0.099)	(0.055)														
(MA) Maternal aspiration	0.159**	0.433***														
	(0.071)	(0.037)														
(FA) Paternal aspiration	0.152**	0.204***														
	(0.066)	(0.035)														
Years of education completed by mother	0.0450	0.0221	0.00428	0.0395**	0.0214	-0.00750	-0.0101	0.0101	0.244***							
	(0.049)	(0.028)	(0.016)	(0.017)	(0.018)	(0.019)	(0.021)	(0.022)	(0.031)							
Years of education completed by father	-0.0466	0.0519**								0.0155	0.0560***	0.0373**	0.00260	0.0382**	0.00704	0.289***
	(0.039)	(0.022)								(0.017)	(0.016)	(0.016)	(0.017)	(0.017)	(0.017)	(0.024)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B. 6 Results of GSEM for Females (Continuous Part from Table B.5)

	Model 2b															
Variables	Grade	Aspiration	M1	M2	M3	M4	M5	M6	MA	F1	F2	F3	F4	F5	F6	FA
Employment status (ref. non-employed)																
Mother: regular employment	0.297	0.0210	-0.156**	-0.0121	0.0466	-0.0526	-0.0248	-0.0250	-0.0487							
	(0.206)	(0.116)	(0.076)	(0.081)	(0.086)	(0.092)	(0.100)	(0.107)	(0.147)							
Mother: contractual employment	0.0561	0.178*	-0.0940	0.0635	0.0720	-0.0257	0.0251	0.0863	-0.206*							
	(0.170)	(0.096)	(0.063)	(0.067)	(0.071)	(0.076)	(0.083)	(0.088)	(0.121)							
Mother: other	-0.0814	0.226	-0.113	0.0653	0.0304	0.141	0.102	0.290*	-0.0735							
	(0.295)	(0.173)	(0.105)	(0.113)	(0.119)	(0.128)	(0.139)	(0.148)	(0.205)							
Father: regular employment	0.326	0.0995								-0.369	-0.253	-0.186	-0.352	-0.235	0.0495	0.281
	(0.496)	(0.263)								(0.243)	(0.233)	(0.236)	(0.249)	(0.245)	(0.249)	(0.353)
Father: contractual employment	-0.0577	0.0413								-0.251	-0.194	-0.133	-0.143	-0.196	0.0500	0.739*
	(0.572)	(0.308)								(0.285)	(0.274)	(0.278)	(0.293)	(0.288)	(0.293)	(0.415)
Father: directors	0.585	0.339								-0.201	-0.129	-0.243	-0.328	-0.303	0.282	0.603
	(0.571)	(0.307)								(0.284)	(0.273)	(0.276)	(0.292)	(0.287)	(0.292)	(0.413)
Father: other	0.113	-0.0945								-0.272	-0.0711	-0.00635	-0.206	-0.127	0.182	0.174
	(0.529)	(0.282)								(0.259)	(0.249)	(0.252)	(0.266)	(0.262)	(0.266)	(0.377)
Household income	-8.23e-06	2.65e-05	0.000220***	7.77e-05	-6.73e-06	0.000149*	0.000257***	0.000172*	0.000760***	0.000126	0.000122	6.38e-05	-1.11e-07	0.000141	8.39e-05	0.000676***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Father listens to adolescent and gives advice	-0.170	-0.120														
	(0.167)	(0.095)														
Mother listens to adolescent and gives advice	0.515***	0.117														
	(0.179)	(0.099)														
Relationships of parents	0.0809	0.00369														
	(0.065)	(0.036)														
Number of siblings	-0.251***	0.0317														
	(0.084)	(0.046)														
Type of school (ref. public school)																
Private school	-0.138	0.161														
	(0.231)	(0.124)														
National school	-0.146	0.127														
	(0.447)	(0.269)														
Cram school	-0.00549															
	(0.160)															
Private teacher	-0.544*															
	(0.316)															
Distance learning	0.651***															
	(0.194)															
Lessons related with academic subjects	0.314															
	(0.249)															

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B. 7 Results of GSEM for Females (Continuous Part from Table B.6)

	Model 2b															
Variables	Grade	Aspiration	M1	M2	M3	M4	M5	M6	MA	F1	F2	F3	F4	F5	F6	FA
Hours of study during weekdays	0.0898															
	(0.067)															
Hours of study during weekends	0.0605*															
	(0.036)															
Size of city	-0.00140	0.000161														
	(0.001)	(0.001)														
Constant		3.845***	3.392***	2.730***	2.950***	3.312***	2.481***	2.609***	11.29***	2.563***	2.014***	2.115***	2.494***	1.954***	2.106***	10.03***
		(0.537)	(0.207)	(0.222)	(0.234)	(0.251)	(0.273)	(0.292)	(0.402)	(0.319)	(0.307)	(0.311)	(0.328)	(0.323)	(0.328)	(0.465)
Observations	861	861	861	861	861	861	861	861	861	861	861	861	861	861	861	861

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: AIC for Model 2b = 38457.

Table B. 8 Results of Robustness Checks for Males

Model 1c (N = 221): Result of estimation after dropping observations of paternal aspiration of 16 and 18 school years
Model 1d (N = 212): Result of estuation after dropping observations of maternal aspiration of 16 and 18 school years

	Model 1c		Model 1d	
Variables	Grade	Aspiration	Grade	Aspiration
Adolescents' educational aspiration	0.280***		0.260***	
	(0.089)		(0.091)	
Discussion				
Mother: episodes from school	-0.00853	-0.0878	0.151	-0.292**
	(0.200)	(0.133)	(0.225)	(0.140)
Mother: about study and grades				
Mother: future and life course after graduation	0.309		0.144	
	(0.200)		(0.203)	
Mother: about friends	-0.224		-0.382**	
	(0.187)		(0.193)	
Mother: about society and news				
Mother: about hobby and extracurricular activities				
Father: about episode from school				
Father: about study and grades	0.350*		0.226	
	(0.191)		(0.198)	
Father: future and life course after graduation	-0.172	-0.0467	-0.0223	0.174
	(0.217)	(0.132)	(0.228)	(0.127)
Father: about friends		-0.119		-0.00521
		(0.131)		(0.125)
Father: about society and news	0.271*		0.421**	
	(0.161)		(0.178)	
Father: about hobby and extracurricular activities	-0.233	0.273**	-0.290*	0.201
	(0.170)	(0.127)	(0.176)	(0.123)
Maternal aspiration	0.198**	0.322***	0.230	0.459***
	(0.097)	(0.071)	(0.160)	(0.116)
Paternal aspiration	0.0867	0.343***	0.0777	0.225***
	(0.152)	(0.125)	(0.092)	(0.073)
Years of education completed by mother	0.00419		-0.00682	
	(0.096)		(0.095)	
Years of education completed by father		-0.0482		-0.0265
		(0.059)		(0.058)
Employment status (ref. non-employed)				
Mother: regular employment				
Mother: contractual employment				
Mother: other				
Father: regular employment				
Father: contractual employment		-0.572		-0.644
		(0.493)		(0.460)
Father: directors				
Father: other				

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B. 9 Results of Robustness Checks for Males (Continuous Part from Table B.8)

	Model 1b		Model 1c	
	Grade	Aspiration	Grade	Aspiration
Variables				
Household income		0.000324		0.000244
		(0.000)		(0.000)
Father listens to adolescent and gives advice				
Mother listens to adolescent and gives advice				
Relationships of parents	0.214		0.186	
	(0.133)		(0.137)	
Number of siblings	0.291*	-0.184	0.394**	-0.188
	(0.161)	(0.124)	(0.173)	(0.128)
Type of school (ref. public school)				
Private school				
National school				
Cram school		0.271		-0.179
		(0.217)		(0.215)
Private teacher	-0.879		-1.703***	
	(0.641)		(0.637)	
Distance learning	0.441		0.699	
	(0.439)		(0.471)	
Lessons related with academic subjects	-12.90		-0.354	
	(523.000)		(1.389)	
Hours of study during weekdays				
Hours of study during weekends	0.335***		0.420***	
	(0.069)		(0.075)	
Size of city	-0.00430	0.000223	-0.00256	0.000219
	(0.003)	(0.002)	(0.003)	(0.002)
Constant		5.090***		4.845***
		(1.587)		(1.518)
Observations	221	221	212	212

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B. 10 Results of Robustness Checks for Females: Parental Aspiration

Model 2c (N = 342): Result of estimation after dropping observations of paternal aspiration of 16 and 18 school years
Model 2d (N = 328): Result of estuation after dropping observations of maternal aspiration of 16 and 18 school years
Model 2e (N = 861): Result of estimation that dropped the variable of paternal aspiration

	Model 2c		Model 2d		Model 2e	
Variables	Grade	Aspiration	Grade	Aspiration	Grade	Aspiration
Adolescents' educational aspiration	0.347***		0.206**		0.409***	
	(0.082)		(0.086)		(0.060)	
Discussion						
Mother: episodes from school						
Mother: about study and grades	0.213		0.184		0.326***	
	(0.159)		(0.165)		(0.103)	
Mother: future and life course after graduation						
Mother: about friends						
Mother: about society and news						
Mother: about hobby and extracurricular activities						
Father: about episode from school	-0.143		-0.0180		-0.147*	
	(0.138)		(0.140)		(0.089)	
Father: about study and grades	0.427**		0.498***		0.388***	
	(0.170)		(0.180)		(0.108)	
Father: future and life course after graduation	-0.279*		-0.412**		-0.260**	
	(0.167)		(0.170)		(0.103)	
Father: about friends		-0.0965		-0.0810		-0.0845**
		(0.074)		(0.076)		(0.040)
Father: about society and news	0.00381	0.200**	0.0107	0.172**	0.140*	0.179***
	(0.129)	(0.079)	(0.129)	(0.081)	(0.078)	(0.041)
Father: about hobby and extracurricular activities	0.0206		-0.0530		-0.166**	
	(0.130)		(0.135)		(0.080)	
Maternal aspiration	0.109	0.435***	-0.0943	0.255***	0.248***	0.592***
	(0.089)	(0.056)	(0.129)	(0.085)	(0.058)	(0.027)
Paternal aspiration	-0.0375	0.176**	0.184**	0.274***		
	(0.115)	(0.077)	(0.094)	(0.062)		
Years of education completed by mother						0.0964***
						(0.018)
Years of education completed by father		0.0110		0.0404		
		(0.037)		(0.036)		
Employment status (ref. non-employed)						
Mother: regular employment	0.445*		0.621**		0.263*	
	(0.268)		(0.285)		(0.159)	
Mother: contractual employment		0.0863		0.0140		0.160**
		(0.142)		(0.144)		(0.074)
Mother: other						
Father: regular employment	0.359		0.450*		0.303*	
	(0.250)		(0.266)		(0.171)	
Father: contractual employment						
Father: directors	0.000379	0.429	0.864	0.639*	0.556*	0.315*
	(0.620)	(0.415)	(0.584)	(0.351)	(0.325)	(0.167)
Father: other						

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B. 11 Results of Robustness Checks for Females: Parental Aspiration (Continuous Part from Table B.10)

	Model 2b		Model 2c		Model 2d	
	Grade	Aspiration	Grade	Aspiration	Grade	Aspiration
Variables						
Household income						
Father listens to adolescent and gives advice						
Mother listens to adolescent and gives advice	0.741***		0.663***		0.458***	
	(0.248)		(0.249)		(0.155)	
Relationships of parents						
Number of siblings	-0.231*		-0.0745		-0.233***	
	(0.127)		(0.133)		(0.083)	
Type of school (ref. public school)						
Private school						
National school						
Cram school						
Private teacher	0.0555		-0.0270		-0.521*	
	(0.455)		(0.405)		(0.302)	
Distance learning	0.444		0.353		0.646***	
	(0.301)		(0.334)		(0.180)	
Lessons related with academic subjects						
Hours of study during weekdays	0.0320		0.0935		0.107*	
	(0.105)		(0.109)		(0.063)	
Hours of study during weekends	0.0835		0.109*		0.0570	
	(0.061)		(0.064)		(0.035)	
Size of city						
Constant		5.261***		6.001***		4.455***
		(1.030)		(1.046)		(0.397)
Observations	342	342	328	328	861	861

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B. 12 Results of Robustness Checks for Females: Discussion about Study and Grade

Model 2c (N = 686): Result of estimation after dropping observations of discussing study and grade with fathers often (coded as 4)
Model 2d (N = 431): Result of estimation after dropping observations of discussing study and grade with mothers often (coded as 4)

	Model 2f		Model 2g	
Variables	Grade	Aspiration	Grade	Aspiration
Adolescents' educational aspiration	0.335***		0.358***	
	(0.068)		(0.084)	
Discussion				
Mother: episodes from school				
Mother: about study and grades	0.308***		0.0901	
	(0.108)		(0.185)	
Mother: future and life course after graduation				
Mother: about friends				
Mother: about society and news				
Mother: about hobby and extracurricular activities				
Father: about episode from school	-0.127		-0.158	
	(0.101)		(0.131)	
Father: about study and grades	0.500***		0.523***	
	(0.137)		(0.161)	
Father: future and life course after graduation	-0.336***		-0.246	
	(0.119)		(0.151)	
Father: about friends		-0.0835*		-0.0715
		(0.046)		(0.059)
Father: about society and news	0.124	0.165***	0.0288	0.149**
	(0.088)	(0.046)	(0.115)	(0.063)
Father: about hobby and extracurricular activities	-0.216**		-0.0664	
	(0.092)		(0.121)	
Maternal aspiration	0.174**	0.432***	0.212**	0.336***
	(0.076)	(0.040)	(0.093)	(0.054)
Paternal aspiration	0.171**	0.207***	0.0350	0.267***
	(0.069)	(0.038)	(0.090)	(0.052)
Years of education completed by mother				
Years of education completed by father		0.0642***		0.0963***
		(0.020)		(0.027)
Employment status (ref. non-employed)				
Mother: regular employment	0.185		0.426*	
	(0.176)		(0.219)	
Mother: contractual employment		0.138*		0.146
		(0.083)		(0.109)
Mother: other				
Father: regular employment	0.359*		0.445*	
	(0.192)		(0.241)	
Father: contractual employment				
Father: directors	0.513	0.290	0.427	0.274
	(0.369)	(0.193)	(0.437)	(0.237)
Father: other				

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B. 13 Results of Robustness Checks for Females: Discussion about Study and Grade (Continuous Part from Table B.12)

	Model 2e		Model 2f	
	Grade	Aspiration	Grade	Aspiration
Variables				
Household income				
Father listens to adolescent and gives advice				
Mother listens to adolescent and gives advice	0.471***		0.363*	
	(0.169)		(0.193)	
Relationships of parents				
Number of siblings	-0.129		-0.183*	
	(0.092)		(0.109)	
Type of school (ref. public school)				
Private school				
National school				
Cram school				
Private teacher	-0.330		-0.0802	
	(0.332)		(0.386)	
Distance learning	0.699***		0.532**	
	(0.206)		(0.264)	
Lessons related with academic subjects				
Hours of study during weekdays	0.0876		0.114	
	(0.070)		(0.089)	
Hours of study during weekends	0.0501		0.0599	
	(0.039)		(0.051)	
Size of city				
Constant		4.265***		4.346***
		(0.439)		(0.558)
Observations	686	686	431	431

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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