Parent Involvement in Children's Mathematics Achievement

by

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Abstract

Children's academic achievement matters and can have a long-term impact throughout their life. Parents play an important role in the process of children's learning and development. Building on previous research concerning parental involvement, and focusing on children's mathematics achievement specifically, the present study aimed to examine the factor structure of a parent survey to explore possible ways of parents' involvement in their children's education. The second objective of the present study was to investigate the relations among the multiple dimensions of parental involvement and answer the question of how these aspects were related to children's mathematics achievement. The current study used secondary data from a previous survey-design research project. A convenient sample was recruited from an elementary school, including data from 139 parents and 121 children. Principal Component Analysis was conducted with direct oblimin method of rotation resulted in seven components. Five components were retained in the following Path Analysis. Results indicated that parental self-efficacy was positively predicted by parents' attitude about the school and teachers, through the mediator of parents' perceptions about the teacher's contact with them. Moreover, parental self-efficacy was a positive predictor of their specific helping behaviors with children's math and science at home, parents' role construction beliefs, and children's math achievement. However, parents' assistance with science and math was negatively associated with children's math achievement. Future studies can further explore the underlying mechanisms of parents' homework assistance behaviors. Practically, these results could inform intervention programs at school to promote open and positive collaborations between school teachers and parents as a way to communicate strategic participation in children's education, boost parental self-efficacy, and enhance students' mathematics achievement.

Preface

This thesis is an original work by Ye Liu. No part of the thesis has been published previously.

Acknowledgements

I would like to express my sincere appreciation to my supervisor Dr. Jacqueline P. Leighton for her continued support, guidance and academic mentorship during the whole process of my master's degree. Her constructive feedback about writing provides me with opportunities to learn how to write clearly and concisely in English. Her knowledge and insights expand my horizon and deepen my understanding of research. I am also truly grateful for the help offered by my committee members Dr. Ying Cui and Dr. Phillip Sevigny to take their time to read my work and provide valuable feedback.

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Introduction

Academic achievement in school is a crucial prerequisite for subsequent academic and vocational success (Karbach, Gottschling, Spengler, Hegewald, & Spinath, 2013). Specifically, math achievement in the early years is a strong predictor of later academic achievement, financial success, and future career choices (Charette & Meng, 1998; Duncan et al., 2007).

Children's math achievement can be directly or indirectly influenced by several factors, which can be broadly categorized as internal or external. Cognitive abilities, academic self-concept, and intrinsic motivation are examples of internal factors. External factors refer to the potential impact of parents, teachers, or peers. Research indicates that cognitive ability is a strong predictor of academic achievement, including math achievement (Veas, Castejón, Gilar, & Miñano, 2015). Self-concept refers to individuals' self-perceptions, which are formed by experience in and interpretations of one's environment, and can be domain-specific (Shavelson, Hubner, & Stanton, 1976). Researchers demonstrate a positive reciprocal relationship between academic self-concept and academic achievement within the same subject domain such as mathematics (Marsh & Martin, 2011). Intrinsic motivation is another internal factor. Individuals are intrinsically motivated when they voluntarily engage in activities simply for the enjoyment and excitement, rather than to receive material rewards or satisfy constraints (Deci & Ryan, 2000). Some researchers have found that intrinsic motivation is a consistent and positive predictor of academic achievement across different school contexts and cultures (Taylor et al., 2014).

Concerning external determinants, both popularity among peers at school and perceived support from school teachers and staff have been found to be positively correlated with students'

academic achievement (Niehaus, Rudasill, & Rakes, 2012; Veas et al., 2015). Besides peers and teachers, parental involvement can also influence children's math achievement. Researchers have long been interested in the relationship between these two variables as it is not always straightforward (Carmichael & MacDonald, 2016; Fan & Chen, 2001; Sheldon & Epstein, 2005; Van Voorhis, 2011). Although parental involvement has been generally found to be positive (Fan & Chen, 2001), some forms of involvement can be detrimental (Domina, 2005). For example, in a large secondary analysis of longitudinal data of Australian children's math achievement in primary school, researchers found that parental help with homework more than five nights a week had a negative effect on their children's math achievement (Carmichael & MacDonald, 2016). Parental involvement and children's math achievement is also the focus of the present study. Parents play an important role in their children's growth and learning; it is worth investigating how they get involved in children's education and the effects of their personal engagement on children's learning outcomes.

Purpose of the Present Study

The primary purpose of the present study was to explore the factor structure of a parent survey, which was developed by previous researchers (Sheldon & Epstein, 2007) to assess how parents were involved in their elementary school children's academic life. The relationships among aspects of parental involvement are often underexplored. For example, there is a lack of research concerning how parents' beliefs about themselves (e.g., parental role and self-efficacy beliefs) influence their specific involvement behaviors in their children's education.

The secondary purpose of the present study was to investigate the relationships among the aspects of parental involvement measured by the survey and examine how they predicted children's math achievement. The present study focused particularly on math achievement and

parents' specific helping behaviours to build on previous research of elementary school children's academic achievement in math (Carmichael & MacDonald, 2016; Fan & Chen, 2001; Ginsburg-Block, Manz, & McWayne, 2010; Nye, Turner, & Schwartz, 2006; Sheldon & Epstein, 2005). Guided by the Parental Involvement model (Hoover-Dempsey & Sandler, 1995, 1997, 2005) shown in Figure 1, this study specifically examined how parents' perceptions of their children's school and teachers shape their personal beliefs, and how these personal beliefs then influence their specific involvement behaviors at home with their children's math achievement. Multiple levels of the Parental Involvement model, namely Levels 1, 2 and 5, were covered.

The following three research questions were addressed: What is the factor structure of a parent survey developed by Sheldon and Epstein (2007)? What are the relationships among different aspects of parental involvement as measured by the parent survey? How do these aspects predict children's math achievement?

Theoretical Framework: Parental Involvement Process Model

This study was based on the Parental Involvement process model proposed by Hoover-Dempsey and Sandler (1995, 1997, 2005). The theoretical framework is grounded in social learning theory, social cognitive theory and social-cultural theory (Bandura, 1986; Vygotsky, 1978). As shown in Figure 1, the model is composed of five sequential levels, offering explanations to questions related to parental involvement in children's education, and how parents' involvement influences student outcomes (Hoover-Dempsey & Sandler, 2005). Level 1, 2 and 5 are relevant to the present study, and brief descriptions are provided as follows.

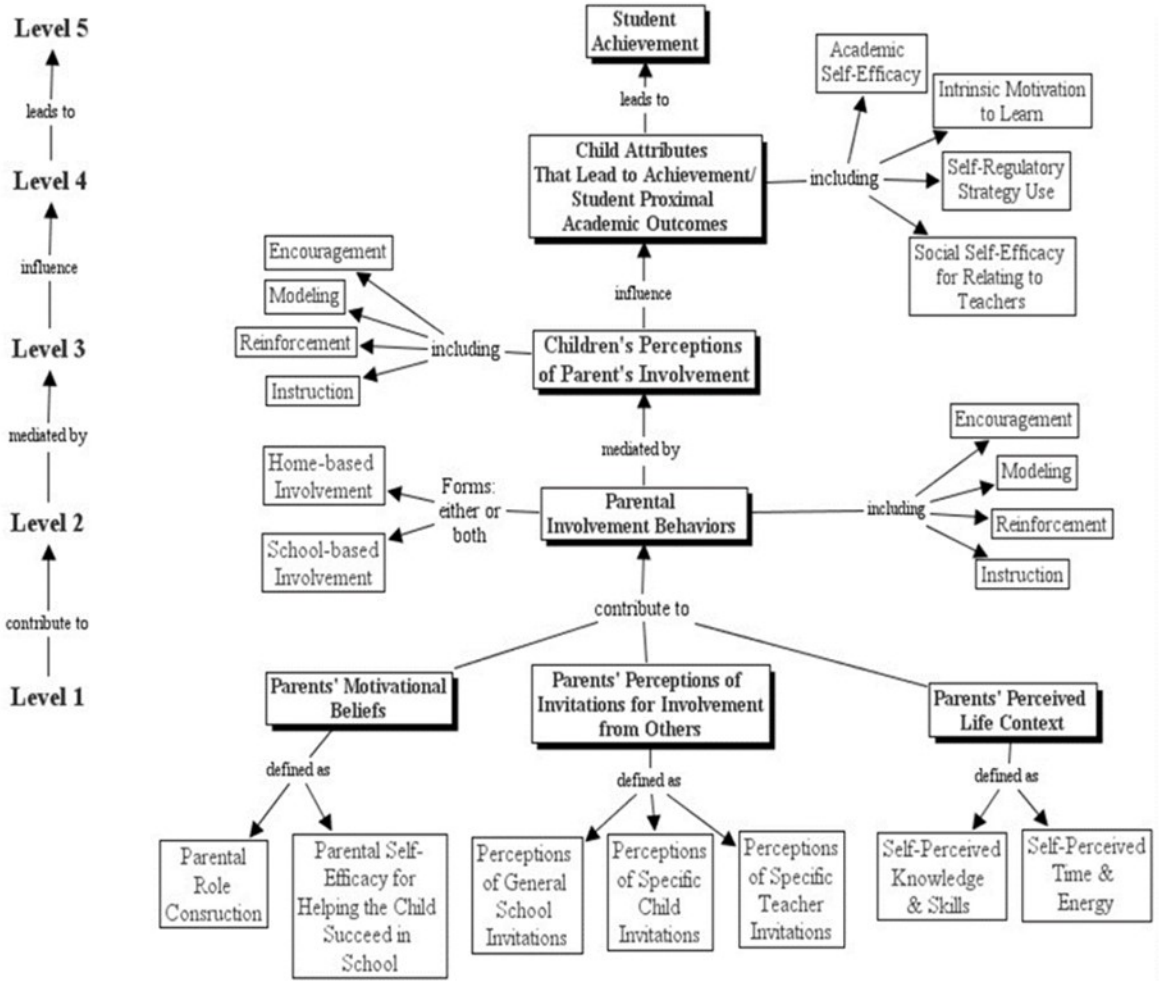

Figure 1. Hoover-Dempsey and Sandler Model of the Parental Involvement Process (Hoover-Dempsey & Sandler, 2005, p. 74)

The first level establishes the foundation of the model, which includes both personal and environmental factors that motivate parents to become involved in their children's education. For example, these factors are categorized as parents' motivational beliefs, their perceptions of general and specific invitations from others (e.g., school, teachers or children) to become involved, and perceived life context. The first motivational belief is parental role construction

(e.g., parents' ideas about what they should do regarding engagement in their children's education), and the other one is parental self-efficacy belief related to helping the child succeed at school (Hoover-Dempsey & Sandler, 1997). Perceived life context includes parents' perceptions of their knowledge, skills, time and energy for involvement (Hoover-Dempsey & Sandler, 2005). Elements at Level 1 contribute to parents' specific forms of involvement behaviors at Level 2.

The second level describes the different forms of parental involvement behaviors, which are generally split into home-based and school-based involvement activities. For example, involvement activities can consist of specific types of behaviors such as encouragement, modelling, reinforcement and instruction. According to the model, these involvement behaviors influence children's learning outcomes indirectly through the mediation of children's perceptions about parents' behaviors and then children's academic-related characteristics (e.g., academic self-efficacy) (Hoover-Dempsey & Sandler, 2005).

The final level shown in the model is student achievement, which reflects the ultimate outcome of the parental involvement process. Student achievement was initially measured by standardized assessments, but other measures such as classroom test scores can be used as well (Hoover-Dempsey & Sandler, 2005). Student achievement is influenced by student attributes, which are associated with proximal academic outcomes at Level 4 (i.e., academic self-efficacy, intrinsic motivation to learn, social self-efficacy for relating to teachers and self-regulatory strategy use) (Hoover-Dempsey & Sandler, 2005). Hoover-Dempsey and Sandler (2005) suggest that these level-4 attributes are sensitive to parents' influence through involvement activities, and they are also persistently related to children's school success.

Overall, the model (Hoover-Dempsey & Sandler,1995, 1997, 2005) implies that parental motivational beliefs for helping their child succeed in school and perceptions of invitations from others may enhance children's academic achievement. Enhancement occurs indirectly through parental involvement behaviors, children's perceptions of parental behavior and children's attributes related to academic achievement. Green, Walker, Hoover-Dempsey, and Sandler (2007) conducted a study to test the relationship between constructs at the first two levels in the Parental Involvement process model. Green et al. (2007) found that after controlling for family socioeconomic status, constructs at Level 1 predicted significant portions of variance in parental involvement at level 2 both at home and school. The definitions of major constructs in the model related to the current study are provided in the following sections.

Parental role construction for involvement. Parental role construction for involvement is defined as parental beliefs about what they should do regarding their children's education and the behavioral patterns they display guided by those beliefs (Hoover-Dempsey & Sandler, 1995, 1997). Parental role construction is a social construct because it is influenced by relevant personal beliefs but also by experiences with individuals and social groups connected with their children's school education (Hoover-Dempsey et al., 2005). Therefore, parental role construction can change. Previous research suggests that parental role construction, namely their beliefs, is a motivator of parents' involvement in children's education (Chrispeels & Rivero, 2001; Hoover-Dempsey et al., 2005; Sheldon, 2002). Additionally, these parental beliefs can be altered by school characteristics (e.g., open, collaborative) (Scribner, Young, & Pedroza, 1999) and intervention programs (Chrispeels, González, & Arellano, 2004).

Parental self-efficacy for helping the child succeed in school. Self-efficacy refers to a person's beliefs in his or her abilities to execute actions in ways that are likely to produce desired

results; it is a critical factor that determines the goals people choose and how persistent they are in working toward those goals (Bandura, 1997). According to Bandura (1977), individuals' self-efficacy beliefs come from four major sources of information: direct experiences (e.g., successes), vicarious experiences (e.g., observations), persuasion in verbal form (e.g., feedback, support), and emotional arousal (e.g., positive or negative). Similar to Bandura's theory of self-efficacy (1977) and in relation to parenting, Coleman and Karraker (1998) proposed that parental self-efficacy, from the perspective of mothers, also develops based on sources such as relationships with others (including parents) when they were children, the information parents learn from the external world regarding parenting, and parents' direct interactions with children of their own or others. Another possible source is parents' mental and behavioral readiness for their role as caregivers (Coleman & Karraker, 1998). These sources might also apply to parental self-efficacy in the context of involvement in children's education, with the focus being more school-related rather than parenting in general.

Parental involvement decisions are likely to be based on parents' expectations about the possible outcomes following their actions and judgment of their individual capabilities (Hoover-Dempsey & Sandler, 1997; Walker, Wilkins, Dallaire, Sandler, & Hoover-Dempsey, 2005). Hoover-Dempsey and colleagues (2005) proposed that parental self-efficacy is a motivator of parental involvement in children's education. Research has shown positive associations between parental self-efficacy regarding children's education and parental involvement (Grolnick, Benjet, Kurowski, & Apostoleris, 1997; Sheldon, 2002; Shumow & Lomax, 2002). For example, most of the parents who homeschool their children were found to have a strong sense of self-efficacy for helping their children succeed in school (Green & Hoover-Dempsey, 2007).

Parental perceptions of invitations from the school and teacher. Parental perceptions of invitations from the school and teachers encompass their perceptions about school staff and school climate in general (Hoover-Dempsey & Sandler, 2005). Teachers' invitations include direct requests from teachers to parents, in various forms, about parental involvement in activities relevant to children's education (Hoover-Dempsey & Sandler, 1995), such as teacher-parent meetings about the child. Hoover-Dempsey and colleagues (2005) indicated that these invitations are important because they imply that parents' participation in their children's learning is expected by the school and its members, welcomed and considered valuable. Hence, these perceived invitations could potentially increase parental role construction beliefs and self-efficacy in helping with their children's schooling (Hoover-Dempsey et al., 2005). School climate is also vital to the enhancement of parental involvement (Griffith, 1998; Lopez, Sanchez, & Hamilton, 2000). Parents' perception of school climate is considered an influential factor in predicting parental role construction beliefs (Whitaker & Hoover-Dempsey, 2013). Positive associations between teacher invitations and parent involvement have been found (Simon, 2004).

Parental Involvement

Parental involvement is conceptualized as a multidimensional construct (Boonk, Gijselaers, Ritzen, & Brand-Gruwel, 2018). Its operational definition in the literature has been inconsistent and somewhat unclear (Fan & Chen, 2001). For example, some researchers define parental involvement generally as the investment parents or caregivers make in their children's education, which can take various forms (LaRocque, Kleiman, & Darling, 2011). Other researchers have offered more specific definitions of parental involvement by including a range of parental activities both at home and at school that are related to children's learning in school (Hoover-Dempsey & Sandler, 1997) or a set of parental behaviors at home and school that support their

children's educational progress (El Nokali, Bachman, & Votruba-Drzal, 2010). Regardless of the definition, however, some activities are mentioned consistently across studies, such as homework assistance, communication with teachers and volunteering at schools. Based on a recent extensive review of the literature, Boonk, Gijselaers, Ritzen, and Brand-Gruwel (2018) divide parental involvement into two categories: home-based and school-based involvement. Home-based involvement includes parents' activities and behaviors at home that are designed to promote their children's learning (e.g., homework assistance). School-based involvement refers to those activities they do at school (e.g., volunteering on school field trips). Some researchers also suggest that parental expectations for their children, including parental values and attitudes regarding their children's education are part of parental involvement (El Nokali, Bachman, & Votruba-Drzal, 2010; Englund, Luckner, Whaley, & Egeland, 2004).

In the present study, the survey developed by Sheldon and Epstein (2007) incorporated multiple different aspects of parental involvement, contributing to an inclusive definition of parental involvement. As a result, parental involvement included the following dimensions: parents' attitudes about the school, beliefs about their involvement in children's education, perceptions of teacher-parent contact about the child, and specific behaviors (e.g., helping with children's science and math learning at home).

Operationalize Academic Achievement

The measure of children's academic achievement often varies across studies (Wilder, 2014). In general, the following ways have been used as indicators of academic achievement. For example, overall grades (grade point average), standardized tests and teacher rating scales (Jeynes, 2003, 2005, 2007). Some researchers also design tests based on the curriculum (Erion, 2006). Grades from classroom assignments and homework reflect alternate evidence for

academic achievement (Patall, Cooper, & Robinson, 2008). Among these different ways of measuring achievement, it has been suggested that there is not enough evidence to show that one way is better than another (Wilder, 2014). In the present study, student achievement was measured by teachers' classroom-based assessments, including in-class assignments, homework, quizzes, and end-of-unit tests. Large-scale standardized test scores were not used because they were only available for one grade out of the six grades involved in the present study.

Parental Involvement and Academic Achievement

Previous research demonstrates a moderate positive correlation between parental involvement and academic achievement assessed by children's grades or grade point average (Fan & Chen, 2001); however, correlations between parental involvement and achievement scores in subject areas such as math and reading were found to be low (Fan & Chen, 2001). In fact, some researchers found that increases in parent involvement did not necessarily predict changes in elementary school children's academic achievement (Carmichael & MacDonald, 2016; El Nokali, Bachman, & Votruba-Drzal, 2010). According to some researchers (Castro et al., 2015; Ma, Shen, Krenn, Hu & Yuan, 2016; Wilder, 2014), there is a positive relationship between parental involvement and academic achievement generally. Nonetheless, the strength of the relationship varies depending on the specific definitions of parental involvement and achievement used in a given study (Wilder, 2014). Second, the specific association between parental involvement with homework and student academic achievement appears to be mixed (Carmichael & MacDonald, 2016). Finally, the positive effect of parental involvement on student achievement (e.g., Wilder, 2014) has also been mixed with respect to its generalizability across ethnic groups as some studies have found it to be negative (Boonk, Gijselaers, Ritzen, & Brand-Gruwel, 2018).

Recently, some researchers (Boonk et al., 2018) have shown a generally positive association (small to medium in effect size) between parental involvement and children's academic achievement, including similarities and differences among different age groups of students. In terms of similarities, for both elementary school children (6-12 years old) and those in higher grade levels (12-18 years old), parental expectations and aspirations were found to be positively related to academic achievement (Antonopoulou, Koutrouba, & Babalis, 2011; Choi, Chang, Kim, & Reio, 2015; Gubbins & Otero, 2016; Phillipson & Phillipson, 2012). Also, parental academic-related support and encouragement were also found to be positively associated with academic achievement (Chen & Gregory, 2010; Gordon & Cui, 2012; Hung, 2007; Rogers, Theule, Ryan, Adams, & Keating, 2009).When it comes to differences, among students of older age groups (adolescents and young adults), more parent-child education-related discussions took place, which were positively associated with their academic achievement (Gordon & Cui, 2012; Hayes, 2012).

Among elementary school children, the influence of parents' specific school involvement on academic achievement was not clear (Johnson & Hull, 2014; McBride, Dyer, Liu, Brown, & Hong, 2009; Stright & Yeo, 2013). One area of particular inconsistency is the relation between parental involvement in homework and elementary school children's academic achievement (Driessen, Smit, & Sleegers, 2005; Tam & Chan, 2009). Among a sample of students between 10 to 16 years of age, perceived homework control from parents was negatively associated with their academic achievement (Núñez et al., 2015). In addition, homework assistance and homework checking were negatively related to adolescent students' academic achievement (Altschul, 2011; Strayhorn, 2010).

The relation between parental involvement and children's academic achievement is clearly intricate. For example, studies have demonstrated the mediating effects of children's characteristics, such as children's cognitive ability beliefs or academic competencies (Phillipson & Phillipson, 2012 & Rogers et al., 2009). In addition, there have been mixed results regarding the relationship between parental involvement and children's academic achievement across different ethnic groups. Some studies have shown that the positive association between parental involvement and student academic achievement is consistent and similar in strength across ethnic groups among both elementary and secondary student populations (Jeynes, 2005; Jeynes, 2007; Hill & Tyson; 2009). Other studies have demonstrated some variations. The associations change directions (e.g., from positive to negative) or differ in strengths across ethnicities (e.g., African versus European Americans) (Hill et al., 2004; Lee & Bowen, 2006; Sibley & Dearing, 2014) and the specific parental involvement activities (e.g., parental communication, aspiration) that appear to affect students' academic achievement differ across ethnic groups (e.g., White, Asian, African Americans) (Hong & Ho, 2005).

Some studies have indicated that parents with socio-economic status (SES), including higher income or levels of education tend to engage in certain parental involvement activities more often (e.g., school-based, home-based or both) than parents with lower income or levels of education (Choi et al., 2015; Lee & Bowen, 2006; Wang & Sheik-Khalil, 2014). For example, parents with high SES get involved in children's literacy activities more often at an early stage (before children entering first grade) (Hemmerechts, Agirdag, & Kavadias, 2017). Generally, students (both in elementary and secondary) from higher income families or with more educated parents were reported to have higher levels of academic achievement (Choi et al., 2015; Hill et al., 2004; Lee & Bowen, 2006).

Focusing on math achievement specifically, Sheldon and Epstein (2005) indicate that school practices are important to consider in fostering parental involvement. For example, schools' effective implementation of practices that promoted families' involvement in assisting their children's learning in mathematics at home was related to the improvement of students' performance on standardized math achievement tests after controlling for previous math achievement levels (Sheldon & Epstein, 2005). Additionally, certain types of parental involvement (i.e., parental advising, parental educational aspirations) have been found to be positively associated with children's academic engagement, self-efficacy, and intrinsic motivation toward mathematics (Fan & Williams, 2010). As well, activities such as parents providing home-based support for learning and celebrating student accomplishments are crucial for facilitating positive mathematics outcomes in children (Ginsburg-Block et al., 2010). It has been found that parents can influence children's mathematics achievement by reducing mathematics anxiety (Vukovic, Roberts & Green Wright, 2013).

As such, the main purpose of this study was to explore the factor structure of a survey designed by Sheldon and Epstein (2007) to assess how parents are involved in their elementary school children's academic life. A secondary purpose was to investigate the relationships among the aspects of parental involvement measured by the survey and examine how they predicted children's math achievement among a sample of elementary school children.

Method

Data Source

Data used in the present study originated from a previously conducted, one-year longitudinal research project that aimed to investigate the relationship between a specific pedagogical approach used in a public primary school and students' learning outcomes (Leighton, 2013,

2018). The original data were collected in 2012 from 262 students, 25 teachers, and 139 parents associated with the school. The sample comprised a sample of convenience. Using this sample, a secondary data analysis was conducted to address the following research questions: What is the factor structure of a parent survey developed by Sheldon and Epstein (2007)? What are the relationships among different aspects of parental involvement measured by this survey? How do these aspects predict children's math achievement?

Participants

According to the original study, participating students (n = 262) ranged from 6 to 12 years old, including 123 boys (46.9%) and 124 girls (47.3%), and 15 students who did not reveal their gender (5.7%). Just over 70% of the students indicated speaking English at home, and over 70% of students lived with two parents or guardians (Leighton, Guo, Chu, & Tang, 2018). For children whose data were included in the current study, their mean age was around 8.4 years old; and their gender distribution was approximately equal, with girls accounting for 52.5%.

Among the parents (n = 139), 121 were mothers (87.1%), and 17 were fathers (12.2%). Thirty-three percent of the parents had earned a college diploma (n = 46), and forty-five percent (n = 62) completed a graduate degree or obtained graduate credits. Most of the parents reported speaking English at home (85.6%). Regarding ethnic background, 69.1% identified as Caucasian and 11.5% as Asian-Americans. Two parents reported themselves as African Americans; one as Latino and 15.1% self-identified with another ethnic background (Leighton, 2013). Parent demographic characteristics are presented in Table 1. At the stage of path analysis, because parents' and children's data needed to be cross-linked, complete data were available from 121 pairs of parent-child dyads. However, for those parents who did not consent to reveal children's

achievement data, their own data (parental data) were still included and children's data were coded as missing.

Table 1. *Demographics of Parent Participants*

Item	Frequency (*n*)	Percent (%)
Gender of your child		
Boy	65	46.8
Girl	73	52.5
Missing	1	.7
Relationship to your child		
Mother	121	87.1
Father	17	12.2
Missing	1	.7
Education		
Some High School	2	1.4
High School Diploma	12	8.6
Some College	5	3.6
Voc/Tech School	11	7.9
College Diploma	46	33.1
Graduate Degree or Credits	62	44.6
Missing	1	.7
Ethnicity		
Asian-American	16	11.5
Black or African American	2	1.4
White or Caucasian	96	69.1
Hispanic or Latino	1	.7
Other	21	15.1
Missing	3	2.2
Language speaking		
English	119	85.6
French	1	.7
Spanish	2	1.4
Other	15	10.8
Missing	2	1.4
Employment status		
Full-time	69	49.6
Part-time	44	31.7
Not employed	24	17.3
Missing	2	1.4
Employment status of spouse/partner		
Full-time	117	84.2
Part-time	5	3.6

Not employed	9	6.5
Not applicable	6	4.3
Missing	2	1.4

Procedures

Procedures of the original study were based on information provided by the original investigator (Leighton, 2013). Only information relevant to the current study is included herein. First, ethics approval from the University of Alberta Research Ethics Board was received in June 2012. In September, a letter of Invitation and a Consent letter were sent to all parents (students) and teachers of the school. Surveys were delivered to the school, organized and administered to different classes for students and teachers who were interested in participating. School administrative staff distributed student surveys to the teachers, who then administered them to students in their class. A graduate research assistant with extensive teaching experience (over 20 years) was present in the school to help teachers follow standardized administration of the surveys. The school distributed the parent surveys over surface mail or in person when parents picked up the secure package. Later these surveys were returned to the school in a sealed envelope provided by the graduate student assistant. The graduate research assistant collected all surveys from the school in November 2012.

Measures

The present study included two global measures. The first one was the parent survey (Sheldon & Epstein, 2007) that was designed to measure parental involvement as the predictor variable. The second measure was the outcome variable, the mathematics academic achievement of the students.

Parental involvement. The parent survey was an established instrument developed by previous researchers (Sheldon & Epstein, 2007), which measures parents' involvement in the

family and community, whose children are in elementary and middle-school Grades. The original survey included 55 items across five subscales. The parent survey in the present study included all the 55 items, with no wording changes for any of the questions except one (1h), where the name of meetings was revised. Besides that, the survey in the current study also included a section requesting demographic information about the family.

The first subscale measures the school's contact with the parents. Parents were asked how well their child's teacher or someone at the school has done the following activities this school year. A sample item is "My child's teacher or someone at the school tells me how my child is doing in school." Parents responded using a 4-point scale where 1 to 4 indicated "Well," "OK," "Poorly," and "Never" respectively. The second subscale measures parents' attitude about the school. Parents indicated how much they agreed or disagreed with the statements about the school and teachers on a 4-point scale from 1 (Strongly Agree) to 4 (Strongly Disagree). A sample item is "This is a very good school."

The third subscale assesses parents' present family involvement. Parents were asked how often they do certain activities. They rated the activities on a 4-point scale again where 1 to 4 indicated "Everyday/Most Days," "Once a Week," "Once in a While" and "Never" respectively. A sample item is "How often do you read with your child?" The fourth subscale evaluates parents' ideas about their responsibilities. Parents reported how much they agreed or disagreed with the statements about what parents should do on a 4-point scale from 1 (Strongly Agree) to 4 (Strongly Disagree). A sample item is "It is a parent's responsibility to teach their child to value schoolwork." The last subscale measures parents' self-efficacy. Again, parents responded using a 4-point scale from 1 (Strongly Agree) to 4 (Strongly Disagree) to indicate how much they agreed

or disagreed with the statements. A sample item is "I know how to help my child do well in school." Family demographics were the final and sixth part of the survey.

Students' academic achievement outcomes. The measure of students' academic achievement was based on teachers' classroom-based assessment for mid-term grades in Language Arts and Mathematics in 2012. Because the study focused on math achievement, grades in Language Arts were not used as an outcome variable in the analyses. Only assessment at one-time point was included because it was collected at the same time as the parent survey.

According to a published report on the student achievement collected for the study (Leighton et al., 2018), assessment outcome data were collected from the school principal and reflected teachers' classroom-based assessments, including in-class assignments, homework, quizzes, and end-of-unit tests. The students' work assessment was formalized by the school's five-point system applied to achievement. For example, a score of 5 reflected an average of 90-100% or what was termed "excellent" student achievement. A score of 4 indicated an average of 80-89% or very good and a score of 3 demonstrated an average of 65-79% or good on classroom-based assessments. A score of 2 reflected an average of 50-64% or "improvement of achievement was needed," which again was based on classroom-based assessments. A score of 1 represented an average of below 50% or a formal improvement plan is required. Large-scale standardized test scores were not used because they were only available for Grade 3 students.

Data Analytic Strategy

Before conducting any data analyses, all the questions in the survey were reverse coded so that higher scale scores indicated a higher level of parental involvement, in the same direction as math achievement scores for ease of interpretation. Since no previous studies had examined the factor structure of the parent survey by Sheldon and Epstein (2007), the present study aimed to

fill this gap. Due to a sample size of 139, a Principal Component Analysis (PCA) was conducted using SPSS 21.0 to investigate the factor structure of the survey along with a subsequent path analysis of data from 139 parents and 121 children. Two tests were conducted first to demonstrate the appropriateness of the data for structure detection. The Kaiser–Meyer–Olkin test was used to indicate the proportion of variance in the variables that might be attributed to underlying factors (Kaiser, 1970). The Bartlett's Test of Sphericity (Bartlett, 1950) was conducted to test whether there were significant correlations among the variables (Field, 2013). In the present study, the variables were the survey items. The direct oblimin method of rotation was employed because factors were expected to be correlated and this rotation allowed for their correlation (Field, 2013). Direct oblimin is useful as a rotational method because it can be applied even when the factors are not significantly correlated (Beavers, Lounsbury, Richards, Huck, Skolits, & Esquivel, 2013). Data from all parents (n=139) responding to the survey were used at this stage.

The principal component analysis and direct oblimin rotation procedures led to identifying seven components. The first component was *parental self-efficacy*, which included eight items. The second component was *parents' attitude about the school and teachers*, consisting of four items. The third component was *parents' general helping behaviors*, including eight items. The fourth component was *teacher's contact with parents about the child*, composed of five items. The fifth and sixth components included *parents' specific helping behaviors with children's science and math*, and *parental role construction beliefs for involvement*. Both these components contained five items. The seventh and last component reflected the *school's contact about school/community activities*, which encompassed four items. This principal component analysis resulted in 39 out of the total 55 items being included for later analysis.

Although seven components were identified for the parent survey in the previous step, two components were not used in path analysis because they were not related to the current study's purpose. These two components were parents' general helping behaviors and school's contact with parents about school/community activities. The second step of the analysis involved computing scale scores of the parent participants based on the five components to prepare data for path analysis. Scale scores were calculated based on the relevant components by taking the average of scores on items loading on the same component. Finally, the third step of the analysis was conducting a path analysis in M*plus* v. 7.11 (Muthen & Muthen, 2013) based on the scale scores.

The path analysis was conducted using M*plus* v. 7.11 (Muthen & Muthen, 2013) to examine the relations among the component of parental involvement and how these components predicted children's mathematics achievement. Available survey data from 139 parents and 121 children's math achievement scores were used at this stage of analysis. Only children's mathematics achievement was included as the outcome variable because children's achievement in reading/language arts was not relevant to the research questions of the present study. Path analysis was used instead of structural equation modeling because of the small sample size. Researchers have suggested that a typical sample size requirement for studies using structural equation modeling should not be less than 200 (Kline, 2016).

The multivariate normality assumption is not required for PCA when it is used for descriptive purposes (Tabachnick & Fidell, 2013) Before conducting path analysis, however, the normality assumption of scale scores and children's math achievement scores were checked using the Kolmogorov-Smirnov test and the Shapiro-Wilk's test in SPSS. The results indicated that all the variables were significantly different from a normal distribution ($p < 0.01$). The

histograms of the six variables (five were predictors and one was the outcome) show that they were negatively skewed (see Figure 2). Maximum likelihood with robust standard errors estimation (MLR) was used to handle the non-normal data in Mplus. Researchers have indicated that MLR method is robust to violation of normality assumption (J. Wang & X. Wang, 2012).

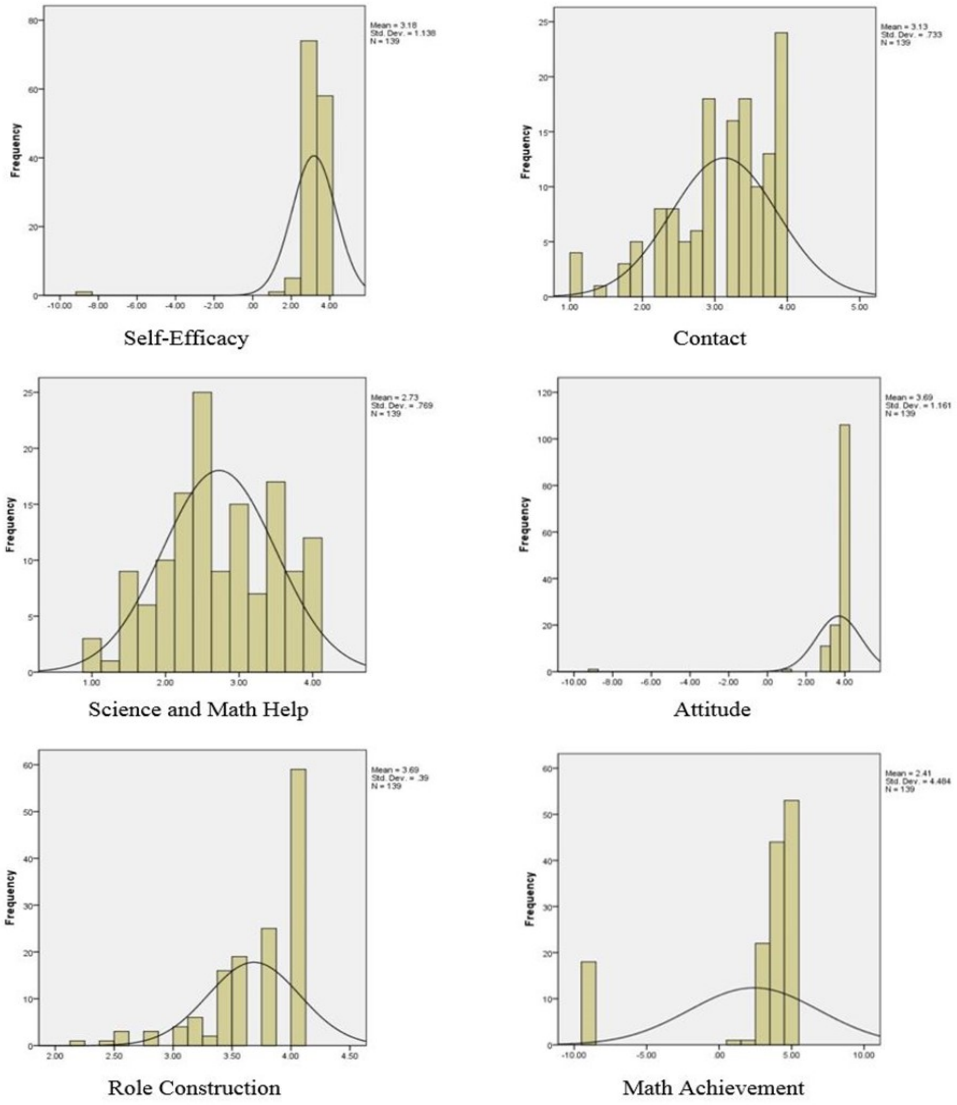

Figure 2. Histograms of the Distributions of the Scale Scores of Predictor Variables and Math Achievement

Note. A value of -9 refers to missing data.

Attitude: parents' attitude about the school and teachers

Contact: teacher's contact with parents about the child

Self-efficacy: parental self-efficacy

Science and math help: parents' helping behaviors with children's science and math

Role construction: parental role construction for involvement

Regarding the missing data, among data obtained from the parent survey, ten items had no missing value, and twenty-three items had one missing case. Four questions had two missing cases. Only one item had three missing cases. In SPSS 21.0, missing data issues were addressed using the listwise deletion method. Listwise deletion method was used instead of pairwise because the latter approach may lead to nonpositive definite correlation matrices, causing estimation problems for subsequent multivariate analyses (Enders, 2010). When conducting the final path analysis in M*plus* v. 7.11 (Muthen & Muthen, 2013), full-information maximum likelihood (FIML) with robust standard error estimation procedures was used to address missing data issues. Previous researchers recommended this procedure as a common missing data estimation approach in M*plus* (Muthen & Asparouhov, 2002).

Results

Principal Component Analysis

Before conducting principal component analysis in SPSS 21.0 to reduce the number of survey variables, the Kaiser–Meyer–Olkin measure (Kaiser, 1970) verified the sampling adequacy for the analysis, KMO = .691. It was recommended that values should be greater than .6 and high values (close to 1.0) generally mean that factor analysis is appropriate given the

data (Hutcheson & Sofroniou, 1999). Moreover, the Bartlett's Test of Sphericity (Bartlett, 1950) was significant ($p < 0.05$) indicating that the correlation matrix of items (variables) is not an identity matrix. These tests and the principal component analysis were conducted on the full 55 items of the parent survey. Based on the scree plot, seven components were retained from the extraction. The eigenvalues of the seven components ranged from 1.61 to 7.95 and in combination explained 62.82% of the total variance. Items that had cross-loadings were removed. Table 2 shows the sample size (*n*), mean (*M*) and standard deviation (*SD*) of the remaining 39 items.

Table 2. *Descriptive Analysis of Survey Items*

Item	***n***	***M***	***SD***
My child's teacher or someone at the school…			
1a. Helps me understand my child's stage of development.	137	2.01	0.89
1b. Tells me how my child is doing in school.	138	1.64	0.80
1c. Ask me to volunteer at the school.	138	1.55	0.80
1f1. Tells me what skills my child needs to learn in: math.	139	1.89	0.91
1f2. Tells me what skills my child needs to learn in: reading/language arts	138	1.83	0.86
1f3. Science	138	1.99	0.93
1g. Provides information on community services that I may want to use with my family.	138	2.16	1.04
1h. Invites me to School Council meetings.	139	1.46	0.79
1m. Includes parents on school committees, such as curriculum, budget, or improvement committees.	138	1.53	0.74
How much do you agree or disagree with the following statements about your child's school and teachers?			
2a. This is a very good school.	138	1.14	0.41
2b. I feel welcome at the school.	138	1.19	0.48
2c. I get along well with my child's teacher(s).	138	1.30	0.56
2d. The teachers at this school care about my child.	138	1.25	0.50
How often do you…			
3a. Read with your child?	139	1.60	0.90
3c. Work with your child on science homework?	138	2.65	0.89
3d. Review and discuss the schoolwork your child brings home?	139	1.31	0.60
3e. Help your child with math	139	1.68	0.77
3f. Visit your child's school?	138	1.45	0.76
3g. Go over spelling or vocabulary with your child?	139	1.57	0.75

3h. Ask your child about what he/she is learning in science?	138	2.12	1.00
3i. Talk to your child's teacher?	138	2.23	0.91
3j. Ask your child about what he/she is learning in math?	139	1.74	0.83
3k. Help your child with reading/language arts homework?	139	1.68	0.88
3l. Help your child understand what he/she is learning in science?	137	2.41	1.00
3m. Help your child prepare for math tests?	136	2.46	1.15
3q. Check to see if your child finished his/her homework?	139	1.23	0.58
It is a parent's responsibility to…			
4a. Make sure that their child learns at school.	137	1.53	0.71
4b. Teach their child to value schoolwork.	138	1.27	0.52
4d. Contact the teacher as soon as academic problems arise.	139	1.32	0.55
4f. Keep track of their child's progress in school.	139	1.30	0.55
4j. Know if their child is having trouble in school.	138	1.14	0.37
How much do you agree or disagree with the following statements?			
5a. I know how to help my child do well in school.	138	1.76	0.60
5b. I never know if I'm getting through to my child.	138	3.06	0.72
5c. I know how to help my child make good grades in school.	137	1.80	0.67
5d. I can motivate my child to do well in school.	138	1.77	0.66
5e. I feel good about my efforts to help my child learn.	138	1.59	0.62
5f. I don't know how to help my child on schoolwork.	138	3.32	0.70
5g. My efforts to help my child learn are successful.	138	1.70	0.59
5h. I make a difference in my child's school performance.	138	1.60	0.61

Direct oblimin rotation was applied to the seven components resulting in sums of squared loadings ranging from 2.71 to 5.44. Table 3 shows the loadings after rotation. The first Component represented parental self-efficacy. The second component represented parents' attitude about the school and teachers. The third component was identified as parents' general helping behaviors. Component 4 represented teacher's contact with parents about the child. Component 5 was identified as parents' helping behaviors with children's science and math. The sixth and seventh component represented parental role construction beliefs for involvement and school's contact with parents about school/community activities respectively. These components all had moderate to high levels of reliabilities, with Cronbach's alpha ranging from .68 to .89 (see Table 3). The correlations among the seven components ranged from -.03 to .24 (see Table 4). One item (i.e., 3j. *How often do you ask your child about what he/she is learning in math?*)

had cross-loading on both component 3 (.41) and 5 (.52). The item was kept under component 5 due to its greater relevance to the fifth component than the third one.

Table 3. *Direct Oblimin Rotation of the Parental Involvement Survey Items*

Item	Rotated Loadings
Component 1: parental self-efficacy (self-efficacy) (α = .86)	
5a. I know how to help my child do well in school.	.77
5b. I never know if I'm getting through to my child.	-.50
5c. I know how to help my child make good grades in school.	.77
5d. I can motivate my child to do well in school.	.63
5e. I feel good about my efforts to help my child learn.	.68
5f. I don't know how to help my child on schoolwork.	-.72
5g. My efforts to help my child learn are successful.	.76
5h. I make a difference in my child's school performance.	.59
Component 2: parents' attitude about the school and teachers (attitude) (α = .88)	
2a. This is a very good school.	.87
2b. I feel welcome at the school.	.91
2c. I get along well with my child's teacher(s).	.70
2d. The teachers at this school care about my child.	.84
Component 3: parents' general helping behaviors (hpgen) (α= .83)	
How often do you…	
3a. Read with your child?	.69
3d. Review and discuss the schoolwork your child brings home?	.62
3e. Help your child with math?	.66
3f. Visit your child's school?	.57
3g. Go over spelling or vocabulary with your child?	.69
3i. Talk to your child's teacher?	.59
3k. Help your child with reading/language arts homework?	.79
3q. Check to see if your child finished his/her homework?	.62
Component 4: teacher's contact with parents about the child (contact) (α = .89)	
My child's teacher or someone at the school…	
1a. Helps me understand my child's stage of development.	.64
1b. Tells me how my child is doing at school.	.76
1f1.Tells me what skills my child needs to learn in: math.	.87
1f2.Tells me what skills my child needs to learn in: reading/language arts	.83
1f3. science	.76
Component 5: parents' helping behaviors with children's science and math (hpscima) (α = .84)	
3c. Work with your child on science homework?	.76

3h. Ask your child about what he/she is learning in science?	.84
3j. Ask your child about what he/she is learning in math?	.52
3l. Help your child understand what he/she is learning in science?	.83
3m. Help your child prepare for math tests?	.67
Component 6: parental role construction for involvement (α = .76)	
It is a parent's responsibility to…	
4a. Make sure that their child learns at school.	.76
4b. Teach their child to value schoolwork.	.66
4d. Contact the teacher as soon as academic problems arise.	.61
4f. Keep track of their child's progress in school.	.60
4j. Know if their child is having trouble in school.	.75
Component 7: school's contact with parents about school and community activities (schac) (α = .68)	
1c. Asks me to volunteer at the school.	.52
1g. Provides information on community services that I may want to use with my family.	.66
1h. Invites me to School Council meetings.	.73
1m. Includes parents on school committees, such as curriculum, budget, or improvement committees.	.65

Table 4. *Correlations Among the Components*

Factor	1	2	3	4	5	6	7
1	-	-	-	-	-	-	-
2	.13	-	-	-	-		-
3	.17	.08	-	-	-		-
4	.19	.11	.03	-	-		-
5	.12	-.04	.13	.08	-		-
6	.24	.05	.13	.14	.13	-	-
7	.07	.08	.05	.17	-.03	.04	-

Five components were retained for later path analyses because component 3 (parents' general helping behaviors) and component 7 (school's contact about school/community activities) were considered unrelated to the overall purpose of the study. Based on the results, scale scores of parent participants were computed for five components in preparation for later path analysis. Scale scores were calculated by taking the average of scores on items loading on the same component. An example is presented as follows. The component labeled as "parents' attitude about the school and teachers" included four items. After reversing scores, a parent's ratings of "3", "4", "3", and "4" on the four items respectively, would have a mean of 3.5 or within the range of "Agree" and "Strongly Agree."

Path Analysis

A path analysis was conducted using M*plus*. 7.11 (Muthen & Muthen, 2013) based on the scale scores. As shown in Table 5, the path analysis resulted in indices that yielded a good overall model fit: $\chi^2 = 10.08$, $df = 8$, $p = .26$ (CFI = .967; TLI = .938, SRMR = .050; RMSEA = .043, 90% CI = .000 to .114). The ratio of χ^2 to the *df* was 1.26. It is suggested that a χ^2/df ratio of three or less is a reasonably good indicator of model fit (Kline, 2005).

Table 5. *Fit Indices for Hypothesized Path Model*

Model	CFI	TLI	SRMR	RMSEA	90% CI	χ^2	*df*
Hypothesized path model	.967	.938	.050	.043	.000, .114	10.08	8

Note. CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; SRMR = Standardized Root-Mean Square Residual; RMSEA = Root-Mean-Square Error of Approximation; CI = Confidence Interval

In addition to this hypothesized model, two different alternative models were tested for comparison. In the first model, the direction between self-efficacy and role construction was switched to see if parental role construction beliefs could predict parental self-efficacy; the model fit indices resulted as follows: $\chi^2 = 14.89$, $df = 8$, $p = .06$ (CFI = .895; TLI = .816, SRMR = .074; RMSEA = .079, 90% CI = .000 to .141). In the other alternative model, the predictive effect of parent-teacher contact on predict parents' attitude was explored; the model fit indices resulted as follows: $\chi^2 = 14.73$, $df = 8$, $p = .06$ (CFI = .888; TLI = .789, SRMR = .072; RMSEA = .078, 90% CI = .000 to .139). These results indicate that both alternative models were worse than the first hypothesized model.

The standardized results are not shown in the Tables but are illustrated in Figure 3. These results indicated that parents' attitude about the school and teachers positively predicted teacher-parent contact ($\beta = .285$, $SE = .122$, $p < .05$). In turn, teacher-parent contact positively predicted parental self-efficacy ($\beta = .251$, $SE = .083$, $p < 0.01$), which then positively predicted parental specific helping behaviors towards children ($\beta = .188$, $SE = .094$, $p < .05$). However, specific helping behaviors towards children's science and math *negatively* predicted children's math achievement ($\beta = -.269$, $SE = .101$, $p < .01$). Parental self-efficacy was also a positive predictor of children's math achievement ($\beta = .276$, $SE = .087$, $p = .001$) and parental role construction beliefs ($\beta = .465$, $SE = .073$, $p < .001$).[1] Parental role construction predicted parents' helping behaviors towards children's science and math, although not significantly ($\beta = .165$, $SE = .09$, $p = .067$). Standardized coefficients of each pathway are shown in Figure 3. In the path model, almost all the standardized coefficients are significant, indicating strong relations among

[1] In a preliminary analysis, parental role construction for involvement did not predict children's math achievement so this path was removed.

components. However, correlations among components are low, as shown in Table 4. A possible explanation for the differences is presented here. In PCA, listwise deletion was used to handle missing data, so less information was used in the calculation of correlations among components. However, in the path model, all the observed variables were based on calculations of the mean of scale scores, which made use of more information. With more information retained in the path model, the likelihood of finding significant relationships among components might have increased.

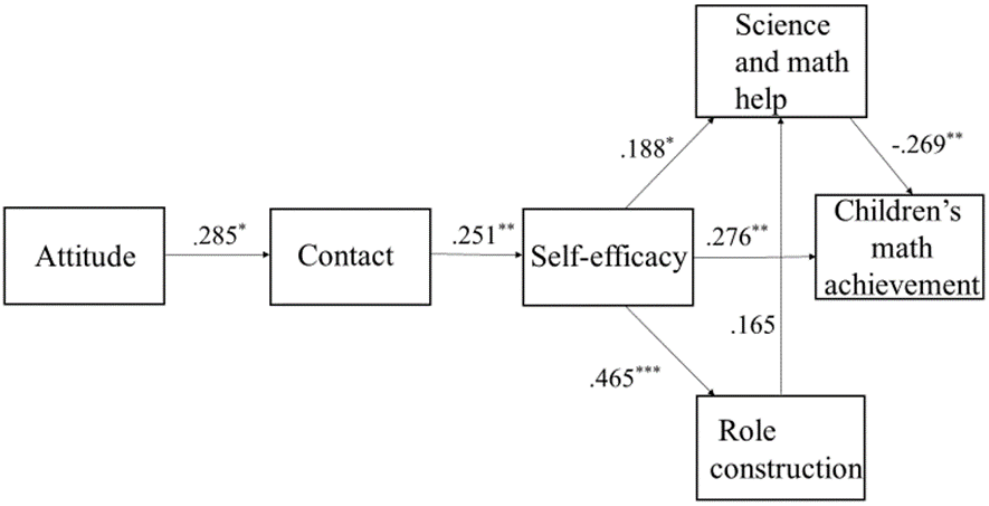

Figure 3. Path Model for Effects of Parental Involvement Factors on Children's Mathematics Achievement

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Attitude: parents' attitude about the school and teachers

Contact: teacher's contact with parents about the child

Self-efficacy: parental self-efficacy

Science and math help: parents' helping behaviors with children's science and math

Role construction: parental role construction for involvement

As can be seen in Figure 3, there are mediating variables in the pathway model that indicate indirect effects among variables. The bias-corrected (BC) bootstrap approach with confidence interval (estimator = maximum likelihood, with 1000 bootstrap; Geiser, 2010) was used to test indirect effects in the model. This approach was selected because the sample size of this study was small. Previous researchers have shown that the bias-corrected (BC) bootstrap method is a good approach for the detection of indirect effects (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). An indirect effect is considered statistically significant at the .05 level if the 95% BC bootstrap confidence interval does *not* include zero (MacKnnon, 2008).

Table 6 shows the statistical significance of the mediation effects of parents' attitude about the school and teachers on children's mathematics achievement. The strength of the specific indirect effects, as well as the 95% bias-corrected (BC) bootstrap confidence intervals (CI), are presented in Table 6. As can be seen in Table 6, the effect of mediators was systematically tested. At the most basic level, the raw coefficients indicate the presence of two statistically significant indirect effects of parents' attitude on children's math achievement, namely, the mediators of teacher-parent contact and parental self-efficacy. The 95% BC bootstrap CI for the indirect effects did not include zero (β = .039, 95% CI = .006 to .122). Next, the analysis also yielded statistically significant indirect effects of parents' attitude on children's math achievement through three mediators, namely, teacher-parent contact, parental self-efficacy, and parents' helping behaviors with children's science and math (β = -.007, 95% CI = -.035 to -.001). Also, the statistically significant but indirect effects of parents' attitude on children's math achievement was also found to be mediated by four factors (i.e., teacher-parent contact, parental self-efficacy, parental role construction, and parents' helping behaviors with children's science and math; β = -.003, 95% CI = -.018 to -.001). However, the standardized coefficients of these

three indirect pathways respectively were not significant. (β = .02, 95% CI = –.01 to .049; β = -.004, 95% CI = –.011 to .004; β = -.001, 95% CI = –.004 to .001). These non-significant standardized results are likely a result of differences in the small sample size. According to Muthen (2009), when there are inconsistencies between raw and standardized coefficients, confidence intervals of raw coefficients should be reported.

Table 6. *Indirect Effect Estimates of Parents' attitude on Children's Math Achievement*

IV	Mediator variable	DV	Estimate (95% CI)[a]
Attitude →	Contact → Self-efficacy →	MA	.039 (.006, .122)*
Attitude →	Contact → Self-efficacy → SciMa help →	MA	-.007 (-.035, -.001)*
Attitude →	Contact → Self-efficacy → Role construction → SciMa help →	MA	-.003 (-.018, -.001)*
Attitude →	Contact → Self-efficacy →	MA	.020 (-.010, .049)
Attitude →	Contact → Self-efficacy → SciMa help →	MA	-.004 (-.011, .004)
Attitude →	Contact → Self-efficacy → Role construction → SciMa help →	MA	-.001 (-.004, .001)

Note. Numbers in parentheses represent 95% bias-corrected bootstrap confidence intervals. The first three lines showed raw coefficients and the latter three lines contained standardized results.

* This 95% confidence interval excludes zero and therefore is significant at $p < .05$.

IV =Independent Variable (Parents' attitude about the school and teachers)

DV = Dependent Variable (Children's Mathematics Achievement)

Attitude: Parents' attitude about the school and teachers

Contact: teacher's contact with parents about the child

Self-efficacy: parental self-efficacy

SciMa help: parents' helping behaviors with children's science and math

MA: Children's mathematics achievement

Overall, R-Square index showed that the model explained 6.3% of the variance of parental self-efficacy, 8.1% of the variance of teacher-parent contact, 9.1% of the variance of parents' specific helping behaviors with children's science and math. Finally, the hypothesized model accounted for 21.6% of the variance of parental role construction beliefs for involvement and 10.9% of the variance of children's math achievement.

Discussion

The first several paragraphs will focus on answering the research questions outlined in the introduction. Then, implications, limitations and future research directions will be discussed. The current study aimed to address the following research questions: What is the factor structure of a parent survey developed by Sheldon and Epstein (2007)? What are the relationships among different aspects of parental involvement measured by the survey? How do these aspects predict children's math achievement?

Factor Structure of the Parent Survey

The KMO and Bartlett tests showed that the data collected by means of the survey were appropriate for conducting a principal component analysis. Based on a principal component analysis with a direct oblimin rotation, seven components based on 39 out of the 55 items were found. The seven components covered different aspects of parental involvement, such as beliefs, perceptions, and behaviors, with moderate to high internal consistency. These results suggested that the parent survey should be considered to be a multidimensional measure of parental involvement.

Relations Among Aspects of Parental Involvement

The results showed that parents' perceptions of the general school climate (parents' attitude) positively predicted their perceptions of teacher invitations (parent-teacher contact). In turn,

perceptions of teacher invitations positively predicted parental self-efficacy beliefs. Parental sense of self-efficacy was a positive predictor of their role construction beliefs and specific helping behaviors with their children's learning in science and math. These results are similar to previous research (Whitaker & Hoover-Dempsey, 2013), and are consistent with the suggestion that invitations from important others at school may contribute significantly to the increase in both parental self-efficacy and role construction beliefs (Hoover-Dempsey et al., 2005).

Congruent with the parental involvement process model (Hoover-Dempsey & Sandler,1995, 1997, 2005), parental self-efficacy contributed to parents assisting children with their homework directly. However, different from the parental involvement model, the present study indicated that parental perceptions of the school climate and of teacher invitations contributed to their involvement behaviors *indirectly* through parental self-efficacy. Consistent with previous research (Hoover-Dempsey et al., 2005), results from the study indicated that perceptions of school climate and teacher invitations contributed to parental self-efficacy. One way to account for how parental self-efficacy beliefs can predict their involvement behaviors is to consider that these beliefs probably motivate parents to participate (Hoover-Dempsey & Sandler,1995, 1997, 2005). Parents with higher self-efficacy may consider themselves to be more capable of having a positive impact on their children's education than parents with lower self-efficacy beliefs (Hoover-Dempsey & Sandler, 1997; Walker, Wilkins, Dallaire, Sandler, & Hoover-Dempsey, 2005). Thus, they are more likely to become involved as much as possible.

Parental self-efficacy positively predicted role construction beliefs. This association might be explained by considering that when parents have higher self-efficacy, they may see themselves as holding more responsibility in relation to their roles. Finally, it was surprising to find that role beliefs were not significantly correlated with specific involvement behaviors in

helping their children, for example, with homework. However, it is possible that children of parents with stronger role construction beliefs actually require less help because they have been taught to be more independent. Alternatively, parents with stronger role construction beliefs may think they should assist with certain activities, but these beliefs may not correspond with their actual behaviors in daily life due to time and energy constraints.

Overall, these results indicate that when parents have positive perceptions of the school climate, they are more likely to perceive the invitations from teachers in positive ways. These perceptions would possibly enhance their self-efficacy for helping their children succeed in school. Parents with higher self-efficacy tend to report more engagement with their children's learning in science and math. Enhanced self-efficacy may also potentially contribute to the increase in parents' sense of responsibility regarding what they should actively do in their children's education.

Parental Involvement Aspects and Math Achievement

Results indicated that parental self-efficacy was a positive predictor of children's math achievement, consistent with the parental involvement process model (Hoover-Dempsey & Sandler,1995, 1997, 2005). In line with research mentioned previously (Fan & Williams, 2010; Ginsburg-Block et al., 2010), parents who have higher self-efficacy may be more likely to engage in interactions or activities that are positively related to children's math achievement and hold higher expectations for their children. They also may be more capable of reducing children's math anxiety (Vukovic, Roberts & Green Wright, 2013).

The negative association between homework assistance and children's academic achievement found in the present study is consistent with previous research as well (Hill & Tyson, 2009; Jeynes, 2005). Findings concerning the relationship between homework

involvement behaviors and children's academic achievement have been mixed as indicated in the introduction (Driessen, Smit, & Sleegers, 2005; Tam & Chan, 2009). There are some conceivable explanations. First, parents may not know or be familiar with how to help their children learn school subject matter (Wilder, 2014). Although parents might engage in helping behaviors, these behaviors may not be effective or appropriate. It is also possible that children who struggle academically may need more homework assistance from parents (Silinskas, Niemi, Lerkkanen, & Nurmi, 2013; Wilder, 2014). Finally, parents' helping behaviors may exert pressure on children, and result in children developing negative perceptions about themselves, which in turn may be negatively related to their academic achievement. Indeed, Moroni and colleagues (2015) found that during the process of homework assistance, when parents were perceived as interfering and controlling, their help was negatively correlated with students' achievement. Researchers indicate that the quality of parents' homework assistance is more important than its frequency in children's academic development (Pomerantz, Moorman, & Litwack, 2007).

Implications

The present study has both theoretical and practical implications. Theoretically, this study was able to evaluate constructs of the parental involvement process model (Hoover-Dempsey & Sandler, 1995, 1997, 2005) by investigating the relationships among multiple aspects of parental involvement at different levels. The results provided support for the model. The results indicated that positive parental attitudes towards the school and teachers could influence parents' specific helping behaviors in response to the teacher's invitations and parents' own self-efficacy. Some relationships were further investigated, such as the relationship between parental self-efficacy

and role constructions beliefs, and between parental perceptions of invitations from school and teachers. The results highlighted the important and mediating role of parental self-efficacy.

From a pragmatic perspective, the factor structure of the parent survey was examined and provided evidence for the complexity of the construct and reliability of the instrument. These findings could lead to the parent survey being used to inform the design of programs to foster a better school environments and equip teachers with knowledge and skills to evaluate perceptions of their contact with parents so that it is effective. Programs for parents could encourage their strategic participation in children's education and boost their self-efficacy for being able to help their children academically. Interventions can and should be implemented to create opportunities for parental involvement and enhance collaboration between school and families. Finally, researchers can create programs to support different ethnic groups to narrow the achievement gap among different ethnicities and promote equity in education. Supporting families' participation in their children's education can be one way to minimize the achievement gap between majority and ethnic minority children from an early age (Wong & Hughes, 2006). The parent survey can be used to help measure and evaluate parental attitudes, beliefs and perceived actions with the goal to support programming that is designed to facilitate children's growth and help them succeed at school.

Limitations

The results of this study need to be considered in light of the following limitations. First, the present study had a small convenience sample of both parent and child participants. Due to the small sample size, PCA and path analysis were conducted instead of other analytic methods. The small sample size also potentially contributed to the discrepancy between raw and standardized coefficients of the indirect effects in the path model. Participants came from one elementary

school in a moderately-large city in Western Canada; no secondary school students were recruited. Therefore, generalization of results must be limited to the specific attributes of the sample.

The second limitation was related to the instrument. The use of any survey that relies on self-report can present responses that are potentially biased (Duckworth & Yeager, 2015). Parental ratings could be biased and may not have reflected the full picture of parental involvement. In addition, both parents did not complete the survey so the absence of the other parent's self-report needs to be noted. Another issue is the wording in the parent survey regarding parents' role construction beliefs. The perspective in wording of this set of questions is global and does not pertain to the individual filling out the survey specifically (e.g., It is a parent's responsibility to…). In contrast, the wording of questions about parental self-efficacy (e.g., I know…) are specific to the person filling out the survey. In the theoretical model, the two parental motivational beliefs are at the same personal level. However, this difference in wording may contribute to the differential predictive power of these two types of motivational beliefs, with one being significantly predictive of parents' specific helping behaviors (e.g., parental self-efficacy) while the other not (parental role construction).

Additionally, children's match achievement was not based on standardized measures and scores but based on the teachers' assessment. The teacher's assessment may not reflect students' achievement objectively. Besides, the present study did not include overall academic achievement indicators because complete data were not available for all children. Previous research suggests a stronger correlation between parent involvement and global indicators of achievement (such as grade point average) compared with achievement indicators in specific subject areas (Fan & Chen, 2001).

Besides, the survey data were cross-sectional, obtained at a one-time point. Longitudinal data from parents and children were not available so evaluating whether parental involvement might have changed during the rest of the academic year in light of children's math achievement is unknown. Besides, the effects of several moderating variables were not controlled for in the path model, such as social, economic status (SES), ethnicity, and gender. Part of the challenge with including these variables in the model was that the sample of the study was relatively homogeneous, indicating a restriction in range, with a majority of them being Caucasian (69.1%) and speaking English (85.6%). For example, there were no significant differences in scale scores of the factors in relation to parents' education level, employment status, ethnic background, and the gender of the child. In addition, other variables that have been found in the literature to influence children's academic achievement were not measured in the present study such as parents' expectations and children's previous learning experience.

Finally, guided by the parental involvement process model, the present study only focused on some constructs in the model, several variables were not included as they were not measured. Understandably, school officials were hesitant to have long surveys administered to parents, so decisions needed to be made about which questions to include in the survey. For example, specific types of parental involvement behaviors (e.g., modelling, encouragement, and reinforcement) were not included. Although in the larger study conducted by Leighton (2013), children's perceptions of parental involvement and children's attributes related to academic achievement (e.g., academic self-efficacy, intrinsic motivation, and use of self-regulatory strategies) were measured, these were not included in the present secondary data analysis. These measures were not included because the sample was small and the main focus was on parental perceptions. Due to these limitations, the present study needs to be considered alongside other

studies about parental involvement to better understand parental perceptions and activities in connection to their children's achievement.

Future Research Directions

Future studies concerning parental involvement and children's academic achievement could explore the associations between parental self-efficacy and other forms of parental involvement, both at home and in school (e.g., parents' expectations of their children, engagement in different learning activities and educationally-related discussions with their children) to examine the predictive power of parental self-efficacy. The differences between parental self-efficacy and role construction beliefs in predicting other forms of parental involvement can be compared to verify which kind of beliefs play a more important role in motivating parents to participate.

Moreover, researchers need to consider recruiting large and diverse samples to conduct longitudinal studies that include different age groups of child participants (children and adolescents) and their parents. By doing so, investigators can track changes in both parental involvement and children's academic achievement over time and test the effects of previous involvement on later achievement outcomes. Measures of children's psychological and academic-related attributes that mediate the relationship between parental involvement and children's academic achievement should be included. The influence of moderating variables such as SES, ethnicity, and gender should be controlled, noting that there needs to be variability in these variables that can only be obtained by recruting very large samples. Ultimately, the practicality of conducting this type of research needs to be weighed against the informational value. Multiple measures of academic achievement (e.g., grades in specific subject areas, standardized scores, grade point average and teachers' evaluation) could be employed as well.

The finding of a negative association between specific homework helping behaviors and math achievement in the present study calls for further research about the quality of and mechanisms underlying homework assistance, such as different types of behaviors exhibited during the process. Research shows that parents offering support and autonomy behaviors during homework assistance are positively associated with children's academic achievement (Gonida & Cortina, 2014). Future studies could continue this line of research to identify other types of beneficial behaviors that parents could engage in when helping children with homework. Finally, incorporating various research designs is recommended such as drawing on observational and experimental data to make up for the potential bias inherent in survey studies (Boonk, Gijselaers, Ritzen, & Brand-Gruwel, 2018).

Conclusion

This study explored the factor structure of a parent survey developed by previous researchers (Sheldon & Epstein, 2007), examined the relationships among different aspects of parental involvement and investigated how these parental involvement aspects predicted children's math achievement. Seven components were identified, and five of them were retained for final analyses. Results demonstrated that parental attitude about the school and teachers positively predicted teacher-parent contact. This contact then influenced parental self-efficacy. Parental self-efficacy positively predicted their specific homework assistance behaviors with children's science and math, parents' role construction beliefs and children's math achievement. However, parents' specific homework helping behaviors negatively predicted children's math achievement.

These findings highlight the constructive influence of collaborations between the school, teachers, and parents for parental involvement. The results also stress the importance of parental self-efficacy in parental involvement and having a role in predicting children's academic

outcomes. Intervention programs are recommended to enhance partnerships, boost parental self-efficacy and encourage strategic participation in children's schooling to benefit their learning.

References

Altschul, I. (2011). Parental involvement and the academic achievement of Mexican American youths: what kinds of involvement in youths' education matter most?. *Social Work Research*, *35*(3), 159-170. Retrieved from http://www.jstor.org.login.ezproxy.library.ualberta.ca/stable/42659796

Antonopoulou, K., Koutrouba, K., & Babalis, T. (2011). Parental involvement in secondary education schools: the views of parents in Greece. *Educational Studies*, *37*(3), 333-344. doi: 10.1080/03055698.2010.506332

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191-215. doi: 10.1037/0033-295X.84.2.191

Bandura, A. (1986). *Social foundations of thought and action*. Upper Saddle River, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Bartlett, M. S. (1950). Tests of significance in factor analysis. *British Journal of Mathematical and Statistical Psychology*, *3*(2), 77-85. doi: 10.1111/j.2044-8317.1950.tb00285.x

Beavers, A. S., Lounsbury, J. W., Richards, J. K., Huck, S. W., Skolits, G. J., & Esquivel, S. L. (2013). Practical considerations for using exploratory factor analysis in educational research. *Practical assessment, research & evaluation*, *18*. Available online: http://pareonline.net/getvn.asp?v=18&n=6

Boonk, L., Gijselaers, H. J., Ritzen, H., & Brand-Gruwel, S. (2018). A review of the relationship between parental involvement indicators and academic achievement. *Educational Research Review*, *24*, 10-30. doi: 10.1016/j.edurev.2018.02.001

Carmichael, C., & MacDonald, A. (2016). Parental influences on primary school children's

mathematics achievement: insights from the Longitudinal Study of Australian Children. *Education 3-13*, *44*(2), 197-211. doi: 10.1080/03004279.2014.939684

Castro, M., Expósito-Casas, E., López-Martín, E., Lizasoain, L., Navarro-Asencio, E., & Gaviria, J. L. (2015). Parental involvement on student academic achievement: A meta-analysis. *Educational Research Review*, *14*, 33-46. doi: 10.1016/j.edurev.2015.01.002

Charette, M. F., & Meng, R. (1998). The determinants of literacy and numeracy, and the effect of literacy and numeracy on labour market outcomes. *The Canadian Journal of Economics / Revue Canadienne D'Economique, 31*(3), 495-517. doi: 10.2307/136200

Chen, W. B., & Gregory, A. (2010). Parental involvement as a protective factor during the transition to high school. *The Journal of Educational Research*, *103*(1), 53-62. doi: 10.1080/00220670903231250

Choi, N., Chang, M., Kim, S., & Reio Jr, T. G. (2015). A structural model of parent involvement with demographic and academic variables. *Psychology in the Schools*, *52*(2), 154-167. doi: 10.1002/pits.21813

Chrispeels, J., & Rivero, E. (2001). Engaging Latino families for student success: How parent education can reshape parents' sense of place in the education of their children. *Peabody Journal of Education*, *76*, 119-169. doi: 10.1207/S15327930pje7602_7

Chrispeels, J., González, M., & Arellano, B. (2004). Evaluation of the effectiveness of the parent institute for quality education in Los Angeles Unified School District September 2003 to May 2004: Evaluation Report. *San Diego, CA: Parent Institute for Quality Education*. Retrieved from http://bridgingworlds.org/P-20/ChrispeelsPIQEevaluation.pdf

Coleman, P. K., & Karraker, K. H. (1998). Self-efficacy and parenting quality: Findings and future applications. *Developmental Review*, *18*(1), 47-85. doi: 10.1006/drev.1997.0448

Cooper, C. E., Crosnoe, R., Suizzo, M. A., & Pituch, K. A. (2010). Poverty, race, and parental involvement during the transition to elementary school. *Journal of Family Issues*, *31*(7), 859-883. doi: 10.1177/0192513X09351515

Deci, E. L., & Ryan, R. M. (2000). The" what" and" why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*(4), 227-268. doi: 10.1207/S15327965PLI1104_01

Domina, T. (2005). Leveling the home advantage: Assessing the effectiveness of parental involvement in elementary school. *Sociology of Education*, *78*(3), 233-249.

Driessen, G., Smit, F., & Sleegers, P. (2005). Parental involvement and educational achievement. *British Educational Research Journal*, *31*(4), 509-532. doi: 10.1080/01411920500148713

Duckworth, A. L., & Yeager, D. S. (2015). Measurement matters: Assessing personal qualities other than cognitive ability for educational purposes. *Educational Researcher*, *44*(4), 237-251. doi: 10.3102/0013189X15584327

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., . . . American, P. A. (2007). School readiness and later achievement. *Developmental Psychology, 43*(6), 1428-1446. doi: 10.1037/0012-1649.43.6.1428

El Nokali, N. E., Bachman, H. J., & Votruba-Drzal, E. (2010). Parent involvement and children's academic and social development in elementary school. *Child Development*, *81*(3), 988-1005. doi:10.1111/j.1467-8624.2010.01447.x

Enders, C. K. (2010). *Applied missing data analysis.* New York: Guilford Press.

Englund, M. M., Luckner, A. E., Whaley, G. J., & Egeland, B. (2004). Children's achievement in early elementary school: Longitudinal effects of parental involvement, expectations, and

quality of assistance. *Journal of Educational Psychology*, *96*(4), 723-730. doi: 10.1037/0022-0663.96.4.723

Erion, J. (2006). Parent tutoring: A meta-analysis. *Education and Treatment of Children*, 79-106. Retrieved from https://www.jstor.org/stable/42899871

Fan, X., & Chen, M. (2001). Parental involvement and students' academic achievement: A meta-analysis. *Educational Psychology Review, 13*(1), 1-22. doi: 10.1023/A:1009048817385

Fan, W., & Williams, C. M. (2010). The effects of parental involvement on students' academic self-efficacy, engagement and intrinsic motivation. *Educational Psychology, 30*(1), 53–74. doi:10.1080/01443410903353302

Field, A. (2013). Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics*. SAGE.

Geiser, C. (2010). *Data analysis with Mplus.* New York: The Guildford Press.

Ginsburg-Block, M., Manz, P. H., & McWayne, C. (2010). Partnering to foster achievement in reading and mathematics. In S. Christenson, & A. Reschly (Eds.), *Handbook of school-family partnerships* (pp. 175–203). New York, NY: Routledge.

Gonida, E. N., & Cortina, K. S. (2014). Parental involvement in homework: Relations with parent and student achievement − related motivational beliefs and achievement. *British Journal of Educational Psychology*, *84*(3), 376-396. doi: 10.1111/bjep.12039

Gordon, M. S., & Cui, M. (2012). The effect of school − specific parenting processes on academic achievement in adolescence and young adulthood. *Family Relations*, *61*(5), 728-741. doi: :10.1111/j.1741-3729.2012.00733.x

Green, C. L., & Hoover-Dempsey, K. V. (2007). Why do parents homeschool? A systematic examination of parental involvement. *Education and Urban Society*, *39*(2), 264-285. doi: 10.1177/0013124506294862

Green, C. L., Walker, J. T., Hoover-Dempsey, K. V., & Sandler, H. M. (2007). Parents' motivations for involvement in children's education: An empirical test of a theoretical model of parental involvement. *Journal of Educational Psychology*, *99*(3), 532-544. doi:10.1037/0022-0663.99.3.532

Griffith, J. (1998). The relation of school structure and social environment to parent involvement in elementary schools. *Elementary School Journal, 99*(1), 53–80. Retrieved from http://www.jstor.org.login.ezproxy.library.ualberta.ca/stable/1002225

Grolnick, W. S., Benjet, C., Kurowski, C. O., & Apostoleris, N. H. (1997). Predictors of parent involvement in children's schooling. *Journal of Educational Psychology*, *89*(3), 538-548. Retrieved from http://dx.doi.org.login.ezproxy.library.ualberta.ca/10.1037/0022-0663.89.3.538

Gubbins, V., & Otero, G. (2016). Effect of the parental involvement style perceived by elementary school students at home on Language and Mathematics performance in Chilean schools. *Educational Studies*, *42*(2), 121-136. doi: 10.1080/03055698.2016.1148586

Hayes, D. (2012). Parental involvement and achievement outcomes in African American adolescents. *Journal of Comparative Family Studies*, 567-582. Stable URL: https://www.jstor.org/stable/23267815

Hemmerechts, K., Agirdag, O., & Kavadias, D. (2017). The relationship between parental literacy involvement, socio-economic status and reading literacy. *Educational Review*, *69*(1), 85-101. doi: 10.1080/00131911.2016.1164667

Hill, N. E., Castellino, D. R., Lansford, J. E., Nowlin, P., Dodge, K. A., Bates, J. E., & Pettit, G. S. (2004). Parent academic involvement as related to school behavior, achievement, and aspirations: Demographic variations across adolescence. *Child Development*, *75*(5), 1491-

1509. doi: 10.1111/j.1467-8624.2004.00753.x

Hill, N. E., & Tyson, D. F. (2009). Parental involvement in middle school: A meta-analytic assessment of the strategies that promote achievement. *Developmental Psychology*, *45*(3), 740. doi: 10.1037/a0015362

Hong, S., & Ho, H. Z. (2005). Direct and indirect longitudinal effects of parental involvement on student achievement: Second-order latent growth modeling across ethnic groups. *Journal of Educational Psychology*, *97*(1), 32. doi: 10.1037/0022-0663.97.1.32

Hoover-Dempsey, K. V., & Sandler, H. M. (1995). Parental involvement in children's education: Why does it make a difference? *Teachers College Record*, *97*(2), 310-331.

Hoover, K. V., & Sandler, H. M. (1997). Why do parents become involved in their children's education? *Review of Educational Research, 67*(1), 3-42. doi: 10.2307/1170618

Hoover-Dempsey, K. V., & Sandler, H. M. (2005, March). *The social context of parental involvement: A path to enhanced achievement.* Final performance report for the Office of Educational Research and Improvement (Grant No. R305T010673). Presented to Project Monitor, Institute of Education Sciences, U.S. Department of Education.

Hoover-Dempsey, K., Walker, J. M. T., Sandler, H. M., Whetsel, D., Green, C. L., Wilkins, A. S., & Closson, K. (2005). Why do parents become involved? Research findings and implications. *Elementary School Journal, 106*(2), 105-130.

Hung, C. L. (2007). Family, schools and Taiwanese children's outcomes. *Educational Research*, *49*(2), 115-125. doi: 10.1080/00131880701369644

Hutcheson, G. D., & Sofroniou, N. (1999). *The multivariate social scientist: Introductory statistics using generalized linear models*. London: Sage.

Jeynes, W. H. (2003). A meta-analysis: The effects of parental involvement on minority

children's academic achievement. *Education and Urban Society*, *35*(2), 202-218. doi: 10.1177/0013124502239392

Jeynes, W. H. (2005). A meta-analysis of the relation of parental involvement to urban elementary school student academic achievement. *Urban Education*, *40*(3), 237-269. doi: 10.1177/0042085905274540

Jeynes, W. H. (2007). The relationship between parental involvement and urban secondary school student academic achievement: A meta-analysis. *Urban Education*, *42*(1), 82-110. doi: 10.1177/0042085906293818

Johnson, U. Y., & Hull, D. M. (2014). Parent involvement and science achievement: A cross-classified multilevel latent growth curve analysis. *The Journal of Educational Research*, *107*(5), 399-409. doi: 10.1080/00220671.2013.807488

Kaiser, H. (1970). A second generation little jiffy. *Psychometrika*, *35*(4), 401-415. doi:10.1007/BF02291817

Karbach, J., Gottschling, J., Spengler, M., Hegewald, K., & Spinath, F. M. (2013). Parental involvement and general cognitive ability as predictors of domain-specific academic achievement in early adolescence. *Learning and Instruction, 23*, 43-51. doi: 10.1016/j.learninstruc.2012.09.004

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York, NY: Guilford Press.

Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). New York: The Guilford Press. Retrieved from http://login.ezproxy.library.ualberta.ca/login?url=http://search.ebscohost.com.login.ezproxy.library.ualberta.ca/login.aspx?direct=true&db=nlebk&AN=1078917&site=eds-

live&scope=site

LaRocque, M., Kleiman, I., & Darling, S. M. (2011). Parental involvement: The missing link in school achievement. *Preventing School Failure, 55*(3), 115-122. doi: 10.1080/10459880903472876

Lee, J. S., & Bowen, N. K. (2006). Parent involvement, cultural capital, and the achievement gap among elementary school children. *American Educational Research Journal*, *43*(2), 193-218. doi: 10.3102/00028312043002193

Leighton, J.P. (February, 2013). Interim Report #1 on Research Project for Suzuki Charter School: Initial Student Data and Findings. University of Alberta, Edmonton, Alberta (44 pages).

Leighton, J.P. (March, 2013). Interim Report #2 on Research Project for Suzuki Charter School: Initial Parent and Teacher Data and Findings. University of Alberta, Edmonton, Alberta (30 pages).

Leighton, J.P., Bustos Gomez, M.C., & Chu, M-W. (September, 2013). Final Report on Research Project for Suzuki Charter School: Student, Teacher, and Parent Findings. University of Alberta, Edmonton, Alberta.

Leighton, J. P., Guo, Q., Chu, M., & Tang, W. (2018). A pedagogical alliance for academic achievement: Socio-emotional effects on assessment outcomes. *Educational Assessment*, *23*(1), 1-23. doi: 10.1080/10627197.2017.1411188

Lopez, L. C., Sanchez, V. V., & Hamilton, M. (2000). Immigrant and native-born Mexican-American parents' involvement in a public school: A preliminary study. *Psychological Reports*, *86*(2), 521-525. Retrieved from https://doi-org.login.ezproxy.library.ualberta.ca/10.2466/pr0.2000.86.2.521

Ma, X., Shen, J., Krenn, H. Y., Hu, S., & Yuan, J. (2016). A meta-analysis of the relationship between learning outcomes and parental involvement during early childhood education and early elementary education. *Educational Psychology Review*, *28*(4), 771-801. doi: 10.1007/s10648-015-9351-1

MacKinnon, D.P. (2008). *Introduction to statistical mediation analysis.* New York, NY: Erlbaum.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7*(1), 83–104. doi:10.1037/1082-989X.7.1.83

Marsh, H. W., & Martin, A. J. (2011). Academic self-concept and academic achievement: Relations and causal ordering. *British Journal of Educational Psychology, 81*(1), 59-77. doi: 10.1348/000709910X503501

McBride, B. A., Dyer, W. J., Liu, Y., Brown, G. L., & Hong, S. (2009). The differential impact of early father and mother involvement on later student achievement. *Journal of Educational Psychology*, *101*(2), 498-508. doi: 10.1037/a0014238

Moroni, S., Dumont, H., Trautwein, U., Niggli, A., & Baeriswyl, F. (2015). The need to distinguish between quantity and quality in research on parental involvement: The example of parental help with homework. *The Journal of Educational Research*, *108*(5), 417-431. doi: 10.1080/00220671.2014.901283

Muthen, B. O., & Asparouhov, T. (2002). *Using Mplus Monte Carlo simulations in practice: A note on non-normal missing data in latent variable models.* Los Angeles, CA: Muthen & Muthen.

Muthen, B. O. (2009, May 28). CIs: unstandardized vs. standardized (M*plus* Discussion forum). Retrieved from http://www.statmodel.com/discussion/messages/11/4331.html?1426677590

Muthen, L. K., & Muthen, B. O. (2013). *Mplus User's Guide* (Version 7.11.). Los Angeles, CA: Muthen & Muthen.

Niehaus, K., Rudasill, K. M., & Rakes, C. R. (2012). A longitudinal study of school connectedness and academic outcomes across sixth grade. *Journal of School Psychology, 50* (4), 443-460. doi: 10.1016/j.jsp.2012.03.002

Núñez, J. C., Suárez, N., Rosário, P., Vallejo, G., Valle, A., & Epstein, J. L. (2015). Relationships between perceived parental involvement in homework, student homework behaviors, and academic achievement: differences among elementary, junior high, and high school students. *Metacognition and learning*, *10*(3), 375-406. doi: https://doi.org/10.1007/s11409-015-9135-5

Nye, C., Turner, H., Schwartz, J., & Nye, C. (2006). Approaches to parent involvement for improving the academic performance. *Campbell Systematic Reviews*, *4*. doi: 10.4073/csr.2006.4

Patall, E. A., Cooper, H., & Robinson, J. C. (2008). Parent involvement in homework: A research synthesis. *Review of Educational Research*, *78*(4), 1039-1101. doi: 10.3102/0034654308325185

Phillipson, S., & Phillipson, S. N. (2012). Children's cognitive ability and their academic achievement: the mediation effects of parental expectations. *Asia Pacific Education Review*, *13*(3), 495-508. doi: 10.1007/s12564-011-9198-1

Pomerantz, E. M., Moorman, E. A., & Litwack, S. D. (2007). The how, whom, and why of parents' involvement in children's academic lives: More is not always better. *Review of Educational Research*, *77*(3), 373-410. doi: 10.3102/003465430305567

Rogers, M. A., Theule, J., Ryan, B. A., Adams, G. R., & Keating, L. (2009). Parental

involvement and children's school achievement: Evidence for mediating processes. *Canadian Journal of School Psychology*, *24*(1), 34-57. doi: 10.1177/0829573508328445

Scribner, J. D., Young, M. D., & Pedroza, A. (1999). Building collaborative relationships with parents. In J. D. Scribner & A. Paredes-Scribner (Eds.), *Lessons from high-performing Hispanic schools: Creating learning communities* (pp 36–60). New York, NY: Teachers College Press.

Shavelson, R. J., Hubner, J. J., & Stanton, G. C. (1976). Self-concept: Validation of construct interpretations. *Review of educational research*, *46*(3), 407-441. doi: 10.2307/1170010

Sheldon, S. B. (2002). Parents'social networks and beliefs as predictors of parent involvement. *The Elementary School Journal*, *102*(4), 301-316. Retrieved from: https://www.jstor.org/stable/1002100?seq=1&cid=pdf-reference#references_tab_contents

Sheldon, S. B., & Epstein, J. L. (2005). Involvement counts: Family and community partnerships and mathematics achievement. *Journal of Educational Research*, *98*(4), 196-206. doi: 10.3200/JOER.98.4.196-207

Sheldon, S. B. & Epstein, J. L. (2007). *Parent survey of family and community involvement in the elementary and middle grades*. Baltimore: Johns Hopkins University, Center on School, Family, and Community Partnerships.

Shumow, L., & Lomax, R. (2002). Parental efficacy: Predictor of parenting behavior and adolescent outcomes. *Parenting: Science and practice*, *2*(2), 127-150. doi: 10.1207/S15327922PAR0202_03

Sibley, E., & Dearing, E. (2014). Family educational involvement and child achievement in early elementary school for American‐born and immigrant families. *Psychology in the*

Schools, *51*(8), 814-831. doi: 10.1002/pits.21784

Silinskas, G., Niemi, P., Lerkkanen, M. K., & Nurmi, J. E. (2013). Children's poor academic performance evokes parental homework assistance—but does it help? *International Journal of Behavioral Development*, *37*(1), 44-56. doi: 10.1177/0165025412456146

Simon, B. S. (2004). High school outreach and family involvement. *Social Psychology of Education*, *7*(2), 185-209. doi: 10.1023/B:SPOE.0000018559.47658.67

Strayhorn, T. L. (2010). The role of schools, families, and psychological variables on math achievement of black high school students. *The High School Journal*, *93*(4), 177-194. Retrieved from stable URL: https://www.jstor.org/stable/40865058

Stright, A. D., & Yeo, K. L. (2013). Maternal parenting styles, school involvement, and children's school achievement and conduct in Singapore. *Journal of Educational Psychology, 106*(1), 301-314. doi: 10.1037/a0033821

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics.* 6th ed. Boston: Pearson Education

Tam, V. C., & Chan, R. M. (2009). Parental involvement in primary children's homework in Hong Kong. *School Community Journal*, *19*(2), 81-100. Retrieved from http://login.ezproxy.library.ualberta.ca/login?url=https://search-proquest-com.login.ezproxy.library.ualberta.ca/docview/195462702?accountid=14474

Taylor, G., Jungert, T., Mageau, G. A., Schattke, K., Dedic, H., Rosenfield, S., & Koestner, R. (2014). A self-determination theory approach to predicting school achievement over time: The unique role of intrinsic motivation. *Contemporary Educational Psychology, 39*, 342-358. doi: 10.1016/j.cedpsych.2014.08.002

Van Voorhis, F. L. (2011). Adding families to the homework equation: A longitudinal study of

mathematics achievement. *Education and Urban Society*, *43*(3), 313-338. doi: 10.1177/0013124510380236

Veas, A., Castejón, J. L., Gilar, R., & Miñano, P. (2015). Academic achievement in early adolescence: The influence of cognitive and non-cognitive variables. *The Journal of General Psychology*, *142*(4), 273-294. doi: 10.1080/00221309.2015.1092940

Vukovic, R. K., Roberts, S. O., & Green Wright, L. (2013). From parental involvement to children's mathematical performance: The role of mathematics anxiety. *Early Education & Development*, *24*(4), 446-467. doi: 10.1080/10409289.2012.693430

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Walker, J. M. T., Wilkins, A. S., Dallaire, J. R., Sandler, H. M., & Hoover-Dempsey, K. (2005). Parental involvement: Model revision through scale development. *Elementary School Journal, 106*(2), 85-104. doi: 10.1086/499193

Walker, J., Shenker, S., & Hoover-Dempsey, K. (2010). Why do parents become involved in their children's education? Implications for school counselors. *Professional School Counseling*, *14*(1), 27-41. Retrieved from Retrieved from http://www.jstor.org.login.ezproxy.library.ualberta.ca/stable/42732747

Wang, M. T., & Sheikh−Khalil, S. (2014). Does parental involvement matter for student achievement and mental health in high school?. *Child Development*, *85*(2), 610-625. doi: 10.1111/cdev.12153

Wang, J., & Wang, X. (2012). *Structural equation modeling: Applications using Mplus*. Chichester, West Sussex: Wiley/Higher Education Press.

Whitaker, M., & Hoover-Dempsey, K. (2013). School influences on parents' role beliefs. *The*

Elementary School Journal, *114*(1), 73-99. doi: 10.1086/671061

Wilder, S. (2014). Effects of parental involvement on academic achievement: A meta-synthesis. *Educational Review, 66*(3), 377-397. doi: 10.1080/00131911.2013.780009

Wong, S. W., & Hughes, J. N. (2006). Ethnicity and language contributions to dimensions of parent involvement. *School Psychology Review*, *35*(4), 645-662. Retrieved from www.ncbi.nlm.nih.gov/pmc/articles/PMC2139999/pdf/nihms35316.