8-1-2009

The Longitudinal Factor Structure of Parent Involvement and Its Impact on Academic Achievement: Findings from the ECLS-K Dataset

Hui-Fang Chen
University of Denver

THE LONGITUDINAL FACTOR STRUCTURE OF PARENT INVOLVEMENT AND ITS IMPACT ON ACADEMIC ACHIEVEMENT: FINDINGS FROM THE ECLS-K DATASET

A Dissertation

Presented to

The Morgridge College of Education

University of Denver

In Partial Fulfillment

Of the Requirements for the Degree

Doctor of Philosophy

---

by

Hui-Fang Chen

August 2009

Advisor: Dr. Duan Zhang

Author: Hui-Fang Chen
Title: THE LONGITUDINAL FACTOR STRUCTURE OF PARENT INVOLVEMENT AND ITS IMPACT ON ACADEMIC ACHIEVEMENT: FINDINGS FROM THE ECLS-K DATASET
Advisor: Dr. Duan Zhang
Degree date: 08/2009

ABSTRACT

The critical role of parent involvement has been endorsed by educators and educational policy in the United States. However, various definitions and approaches to assess parent involvement have yielded inconsistent conclusions regarding the impact of parent involvement on child development and failed to provide foundations for practitioners. These contradictory findings, at least in part, reflected that parent involvement is a multidimensional construct which should be captured by many behaviors and activities as well as the limitations of using classical test theory to develop/identify items to assess parent involvement.

This study conducted both CTT and IRT to identify optimal items for assessing parent involvement from kindergarten through the fifth grade using the ECLS-K dataset. 25 items administrated across four data analysis waves were selected to examine the longitudinal factor structure of parent involvement in early childhood. EFA, CFA and multidimensional IRT have yielded the same results that a three-factor model, including school/home involvement, home educational investment, and family routines, fit the data best across time. Additionally, the result of factor invariance indicated that the three-factor model existed from kindergarten through the fifth grade. The results of a Rasch model analysis suggested revising and adding appropriate items for assessing home educational investment and family routines due to low reliability and poor item ordering.

The impact of parent involvement on academic achievement was examined at kindergarten, first, third, and fifth grade respectively, using multiple regression analyses. Also, this study examined the longitudinal influence of parent involvement using latent growth modeling. It was found that the predictive strengthen of domains of parent involvement varied at different time point as well as across four data analysis waves.

The present study provided empirical evidence using advanced statistical techniques to support a valid multi-faceted structure of the construct and its stability and impact on academic achievement during early childhood. It would deepen researchers and practitioners' knowledge of how to assess parent involvement from kindergarten through elementary school years using a multidimensional perspective, and how it is related to children's education.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Acknowledgements

There are many individuals who significantly inspired and helped me accomplish this dissertation. First, I would like to thank my committee chair, Dr. Duan Zhang, who invited me to work on the issue of parent involvement, created, and completed the research ideas. I am delighted to have a very supportive dissertation committee, Dr. Kathy Green, Dr. Gloria Miller, and Tom Obremski. I would like to thank five experts for taking the time to participate in my study. Also, I would like to thank my friends, Tina, Yin, and Lin for their support and encouragement during the dissertation process.

I would especially like to thank Dr. Kathy Green, who is enthusiastic, patient, and always available for answering my questions and supporting me to go through challenges during the study journey in the United States. She is the best professor I have ever had. Lastly, I would like to thank my parents, my younger brother, and Joey for their support and almighty love.

CHAPTER I

INTRODUCTION and LITERATURE REVIEW

Statement of the Problem

The importance of parent involvement has been addressed in educational research and endorsed by educational policy. However, various definitions of parent involvement and various approaches to assess the construct of parent involvement have yielded inconsistent results although most researchers believe that parent involvement has a positive impact on children’s schooling. These discrepant results not only reflect that parent involvement is a multidimensional construct and must be captured by many behaviors and attitudes, but also suggest that using classical test theory (CTT) only to develop measures for assessing parent involvement might be limited to specific groups or lead to biased estimation in data analysis. In order to identify appropriate items to measure parent involvement and to accurately examine the influence of parent involvement, this study used the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) and conducted both CTT and item response theory (IRT) to investigate a multidimensional scale to assess parent involvement from kindergarten to the fifth grade. Also, this study conducted multiple regression to examine the influence of domains of parent involvement on students’ reading and mathematics performance at kindergarten-, first-, third- and fifth-grade, for validate previous research findings. Additionally, the longitudinal impact of parent involvement on children’s academic progress in early childhood through the elementary school years was addressed through latent growth modeling in this study.

Background

International assessments (e.g., TIMSS 2003) indicated that U.S. children performed relatively well in mathematics and science during primary and middle school years, but they were outperformed by their international peers in adolescence through adulthood. Educational researchers believed that this situation would be improved through cooperation between two influential sources of child development, family and school. Bronfenbrenner (2001) proposed that home and school are two of the most influential systems for young children, which provide instructions and support to meet children's major developmental challenges. The collaboration between parents and teachers assists children's transition from home to preschool or from preschool to kindergarten. A successful connection between family and school can enhance children's motivation to learn. For example, parents' participation in education is associated with children's learning engagement, school attendance, and literacy performance. Accordingly, most literature in this area addresses the importance of parent involvement in children's educational development and emphasizes the teamwork between families and schools (e.g., Sheldon & Epstein, 2005).

Researchers who are interested in child development have been working on the issue of parent involvement since the 1970s (e.g., Bronfenbrenner, 1979). Previous research has demonstrated a critical role of family in child development through child rearing practices at home and activities connecting families, schools, and communities. Family factors, such as parents' personality, educational level, occupations, sociocultural and economic status, living together or apart, and agreement on discipline practices are variables which make significant contributions to their children's academic outcomes and social development (e.g., Bodovski & Farkas, 2008; Crozier, 2007; Graaf, Graaf, & Kraaykamp, 2000; Hamilton, Cheng, & Powell, 2007; NCES, 2006; Wu & Qi, 2005).

Currently, the most influential educational policy in the United States, the No Child Left Behind Act of 2001 (abbreviated as NCLB), endorses the impact of parent involvement in children's education. NCLB aims to improve the performance of U.S. primary and secondary schools by increasing the standards of accountability for states, school districts, and schools, as well as providing parents more flexibility in choosing which schools their children will attend. This educational policy recognizes that parents are their children's first and most important teachers, and for students to succeed in school, parents must actively participate in their children's development. It also advocates that schools should empower family and cooperate with parents and community in order to promote the performance of school education. Parents and schools should work hand in hand with parents in the early grades and throughout the school years.

Parent involvement has been defined and measured inconsistently across studies (Fan & Chen, 2001; Kohn, Lengua, & McMahon, 2000). Some researchers defined parent involvement as parent-school partnerships which focus on the school's role in fostering these relationships (e.g., Epstein, 1995; Fantuzzo, Tighe, & Childs, 2000; Trivette & Anderson, 1995). Some highlighted the indirect influence of parent beliefs and expectations on children's achievement via parent involvement from a sociological perspective (Chao, 2000; Sy & Schulenberg, 2005). Others conceptualized parent involvement using home activities and nonhome educational activities (e.g., Kohn, Lengua, & McMahon; Muller, 1993; Sy, Rowley, & Schulenberg, 2007). The specific behaviors of parent involvement remain unclear and no consensus with regard to relevant dimensions and the specificity of the dimensions to be assessed has been achieved. These chaotic operational definitions of parent involvement have led to inconsistencies about how beneficial parent involvement is to students' academic achievement. Research in the parent involvement area has been fragmented and the findings in this area do not provide efficient recommendations for strengthening the relationship between schools and families.

Educational researchers argued that various definitions and approaches to assessing parent involvement have yielded inconsistent findings (e.g., Carpenter, 2005). Even though most researchers believe parent involvement does positively impact children's achievement and it is an important predictor of children's achievement in school (e.g., Christenson, Rounds, & Gourney, 1992; Epstein, 1995; Fan & Chen, 2001), other researchers reported mixed results, including little if any, such measureable effects (e.g., Bobbett, 1995; Ford, 1989), and even negative relations between children's achievement and parent involvement (Deslandes et al., 1997). In addition, previous research indicated parents and teachers view parental involvement from different perspectives. For example, parents consider keeping their children safe and getting them to school (a communitycentric foci) are more important than doing what the school asks them to do (a schoolcentric foci), whereas teachers might define parent involvement as parents being present at school (Lawson, 2003). These discrepant results reflect, at least in part, varying definitions of parent involvement.

Parent involvement is a broad term, and must be captured by a complex construct encompassing many behaviors and attitudes. Researchers have studied it as a multidimensional construct, including direct and indirect parental involvement activities, such as contacting school, helping children's learning at home, or providing substantial investment in children's development (e.g., McWayne, Hampton, Fantuzzo, Cohen, & Sekino, 2004; Grolnick & Slowiaczek, 1994; Kohl, Lengua, & McMahon, 2000). Previous studies have investigated this multidimensional construct using scales; e.g., the Parent-Teacher Involvement Questionnaire (PTIQ, Conduct Problems Prevention Research Group, 1995, cited in Kohl, Lengua, & McMahon, 2000) and the Teacher-Parent Survey (T-PS) (Izzo, Weissberg, Kasprow, & Fendrich, 1999), or single items (e.g., Hamilton, Cheng, & Powell, 2007; Hoover-Dempsey et al., 2001; Wu & Qi, 2005). The Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) dataset, the latest longitudinal study in the United States, contains most of items used for assessing parent involvement in previous research. Therefore, this study investigated potential items to assess parent involvement from kindergarten through elementary school years in the ECLS-K database. These items assess several dimensions of parent involvement, are specific in behavioral scope, capture a variety of parent involvement behaviors, and consist of enough content items to reliably measure the construct.

Researchers have developed measures to examine specific elements of parent involvement using classical test theory (CTT). Most of them conducted an exploratory factor analysis (EFA) and evaluated the reliability of a parent-involvement measure in their studies while a few of them used a confirmatory factor analysis (CFA) to validate a measure of parent involvement. For example, Fantuzzo, Tighe and Childs (2000) used Epstein's theory (1987) and defined parent involvement as basic obligations, school-to-home communications, parent involvement at school, and parent involvement in learning activities at home. These authors developed the Family Involvement Questionnaire (FIQ), a multidimensional rating scale of parent involvement in early childhood education. The FIQ was built in partnership with parents and teachers in a large urban school district across preschool, kindergarten, and first-grade programs in the northeastern United States. The FIQ's development involved a research committee. Exploratory factor analyses revealed high reliability with Cronbach's alphas of 0.85, 0.85, and 0.81 for three constructs: Supportive Home Learning Environment, Direct School Contact, and Inhibited Involvement, respectively. Kohl et al. (2000) conducted a confirmatory factor analysis (CFA) to confirm six factors of multiple-reporter parent involvement: Parent-Teacher Contact, Parent Involvement at School, Quality of Parent-Teacher Relationship, Teacher's Perception of the Parent, Parent Involvement at Home, and Parent Endorsement of School. The authors reported even though a test of multivariate kurtosis, Mardia's coefficient, showed potential distributional problems, they did not consider that kurtosis biased the estimations of fits because there were negligible differences in the parameter estimates using regular versus scaled standard errors. However, the results of their factor analyses revealed that teacher-report items consistently loaded more strongly on the factors, with correlations ranging from 0.52 to 0.93, than did parent-report items, with correlations that ranged from 0.13 to 0.58. This suggests that these items were not appropriate for assessing parent involvement from the parent's perspective due to the lower correlations. Also, it suggests that using these items might fail to indicate the relationship between parent involvement and students' academic achievement. Therefore, the findings of previous studies indicate that there are some limitations in this instance of CTT for developing a measure of parent involvement.

In CTT, measures are sample-specific and sample-dependent, and usage of a measure developed and assessed with CTT might be limited to specific groups and result in mixed findings, at least in part due to the sample demographics (e.g., age, ethnicity, or socioeconomic status). In addition, researchers most of the time used an ordinal scale/item to assess parent involvement and treated ordinal data as interval data which can lead to biased estimation in data analysis (Harwell & Gatti, 2001). Item response theory (IRT) can address some limitations of CTT. With IRT, invariance of item/person parameters can be readily assessed and IRT can provide unbiased estimates of item characteristics. Previous research suggested this sample-free characteristic makes it possible to identify items that are not influenced by sample demographics. In addition, IRT can equate scores obtained from different forms/measures if there are linking items. Researchers will be benefit from using IRT when conducting integrative analyses of parent involvement measures across studies. However, researchers in the parent involvement field have not documented any measure of parent involvement using an IRT approach. Therefore, in order to obtain optimal items for accessing parent involvement in the future, this study used both IRT and CTT, and performed EFA, CFA, and IRT scaling to investigate a multidimensional measure of parent involvement in early childhood education through the elementary school years.

The Purpose of the Study

The main purpose of this study was to identify optimal items to assess parent involvement in the United States from kindergarten through the fifth grade, and to explore the impact of parent involvement on children's academic achievement using the ECLS-K dataset. Previous research has suggested that parent involvement consists of multiple activities, and certain dimensions of parent involvement may have stronger effects on students' academic achievement than others (Trivette & Anderson, 1995). As a result, identifying optimal items to assess parent involvement from kindergarten through elementary school is a crucial issue for researchers and educators who are interested in children's education.

The first study objective was to identify potential items to measure parent involvement from kindergarten to the fifth grade. Twenty five items representing seven domains of parent involvement were selected for this study. The first hypothesis was that the results of the inter-rater agreement from expert reviews would indicate all chosen items reflecting a multidimensional construct of parent involvement. The second hypothesis was that the results of the multidimensional IRT and CFA would indicate an acceptable model fit across every time point. The third hypothesis was that these two methods would yield very similar results of optimal items for assessing parent involvement. Additionally, it was hypothesized that the results would support the utility of operationalizing multiple aspects of parent involvement from kindergarten to fifth grade.

The second study objective was to examine the association between parent involvement dimensions and students' academic achievement. It was hypothesized that the predictive strength of each domain would vary at each time point. Regarding children's progress in their reading and mathematics, it was hypothesized that fit indices would indicate an acceptable model fit for reading and mathematics LGM model, respectively. Secondly, it was hypothesized parent involvement would have a longitudinal impact on reading and mathematics progress, and it was further hypothesized that the importance and significance of activities of parent involvement would vary as well as their relationship with students' achievement.

Literature Review

The number of studies on parental influences and involvement in children's schooling or development is vast. Since the 1970s, researchers such as Sarason (1971) and Lightfoot (1978) recommended that parents should play a more important role in school settings because they and their children are highly influenced by school decisions. In the 1980s, due to the school reform movement, parents were able to share the power to direct school policies with school administrators, and researchers have devoted their efforts to explaining the influence of different levels of parent involvement. However, findings are mixed, and debates over the relative effects of different forms of parent involvement continue (Dimock, O'Donoghue, & Robb, 1996).

Despite its intuitive meaning, generally speaking, the operational definition of parent involvement varies and is not consistent across studies (Fan & Chen, 2001). Most frequently, studies of parent involvement have been guided by different theories (e.g., Coleman, 1988) and models (e.g., Bronfenbrenner, 1979; Epstein, 1995; Grolnick & Slowiaczek, 1994; Hoover-Dempsey & Sandler, 1995; 1997). These theories and models employed in research have yielded diverse measures/items for assessing parent involvement and resulted in discrepancies across studies. Thus, this literature review began with a brief review of U.S. children's academic achievement, and it was followed by theoretical frameworks used within the parent involvement field, including the bioecological model, the social-parent partnership theory, social capital theory, and the parent involvement process model. It ended with a multidimensional conceptualization of parent involvement for positing a comprehensive picture of parent influence on child development. Lastly, the effects of encouraging and discouraging parent involvement within the home and in school, and its influence on children's social and academic development were reviewed.

Children's achievement in the United States

Since the early 1970s, the United States has devoted attention to the development of assessment for students' achievement in reading, mathematics, and science literacy and has participated in several international assessments (Lemke & Gonzales, 2006). The data from each international measure combined with data from national assessments indicated that U.S. students performed relatively well in mathematics and in science at the lower grades (fourth graders) compared to their peers in other countries (the Trends in International Mathematics and Science Study, TIMSS, 1995; 2003). However, when older U.S. students were asked to apply what they have learned in mathematics or to apply scientific skills, they demonstrated less ability than peers in other highly industrialized countries including Germany, Japan, the United Kingdom, and so on. Data on the literacy and numeracy skills of U. S. adults in comparison with their peers from other countries also suggested that the skills of U. S. adults did not compare favorably (Lemke & Gonzales).

In 1995 and 2003, students at the fourth- and eighth-grade level from 25 countries participated in the TIMSS. U.S. fourth graders, in 2003, performed better, on average, than their peers in 13 countries but worse than their peers in 11 countries. When comparing results from 1995 and 2003, the performance of U.S. fourth graders was stable during this period. That is, U.S. students at the fourth-grade level did not show improvement in their mathematics and science. In grade eight, the performance of U.S. students was ranked as 10th out of 34 countries in 2003 and they showed gains in their mathematics skills and science scores from 1995 to 2003. The data suggested U.S. students performed relatively well at the lower grades and showed improvement in the middle school years. However, this progress may not carry over to the high school years.

Based on the data drawn from the Program for International Student Assessment (PISA) in 2003, U.S. 15-year-old students were outperformed by their counterparts in other nations. The average score in mathematics literacy of U.S. 15-year-old students was 483, which was six points lower than the average performance for most of the Organization for Economic Cooperation and Development (OECD) countries (Digest of Education Statistics, 2007). Regarding science literacy, the average score of U.S. students was 491 and it was ranked 22nd of 28 OECD countries. The performance in problem solving was 477, which was 12 points lower than the overall average score. Along with the scale scores, the students' performances were categorized into seven levels from below level 1 (the lowest level of performance) to level 6 (the highest level of performance). The U.S. 15 year olds had a greater percentage of students (25.7%) than the OECD average (21.4%) at the lowest levels (below level 1 and level1). The United States also had a lower percentage (2%) of students at levels 4, 5, and 6 in mathematics literacy. These results indicated that America's 15-year-olds performed worse than half of their international peers in mathematics literacy in 2003 (Digest of Education Statistics, 2007; Lemke et al., 2004; Lemke & Gonzales, 2006; OECD, 2004).

Weak performance in mathematics and science might influence students' choice of their undergraduate degrees. The report of the OECD revealed that the United States awarded 13% of undergraduate degrees in the mathematics and science fields, ranked as the 26th out of 30 OECD countries in 2004. However, Finland, Germany, Korea, and Sweden where students outperformed in mathematics and science areas all awarded at least 30% of their undergraduate degrees in these areas. In addition, the data of the ALL 2003 study (a specific test of general knowledge for adults) showed that U.S. adults were outperformed by adults in Switzerland, Norway, Bermuda, and Canada, and their performance was ranked as 4 out of 5 (OECD). The performance in mathematics and science of U.S. children and adults lags behind students of peers worldwide. This poor performance bears implications for general access of study to posit characteristics associated with high and low achievement. These findings suggest further investigation and more policy research should be conducted in early education through adulthood because the U.S. students did not carry over their learning in mathematics and science in early ages to later life in real-life contexts.

Theoretical Frameworks

<u>The bioecological model of human development</u>

Bronfenbrenner (1979) proposed the bioecological model of human development, and it has become one of the influential theories in developmental psychology. This model emphasizes internal and external influences on child development and defines development as the product of the child, of the environment, and of the nature of the outcome (such as academic achievement). Process, person, context, and time as well as the dynamic, interactive relationships among them constitute the construct of the bioecological model. This model views the environment in terms of nested systems ranging from micro to meso to macro.

Micro-system involves the impact of specific life setting on development, such as home or school, and the people's characteristics in each of these settings. In these settings people directly interact and engage with the child in different activities. Meso-system refers to the relationships between two or more settings, such as the school and the family. It is a system of two or more micro-systems. Macro-system focuses on the linkages and processes taking place between two or more settings (Bronfenbrenner, 1993, p. 24), such as events, values, or expectations in the larger society. For example, the family has a direct connection with different institutions such as the parent's work organization, socio-economic group, and the community. These institutions have a great influence on the growth and development of a child although a child does not interact directly with other people in these institutions. If a parent lives in a poor community, the children of that parent are likely to attend poor school districts. Being a member of a poor community, the child of the family faces a range of social and cultural problems that occur within the community.

In accordance with the bioecological perspective, the interconnections of the events and bi-directionality of effects between organism and environment play important roles in human development (Bronfenbrenner & Morris, 2006). All growth and development take places within the context of the relationship of home, school, and community. For example, as a child is born, he/she is influenced by social and cultural settings around him/her, and also these cultural and social settings are influenced by others. Every family has its own norms, values, cultures, and histories, which are affected by the society and the community. Additionally, all of the connecting agents have a great impact on the child's family which in turn influences the child. Therefore, in order to understand a child we must look at the child's family as well as the context of the community and the larger society, such as children's schools.

Bronfenbrenner (1979) believes that in the modern industrialized society, the development of young children depends on the conditions of parent involvement. According to his perspective, proximal processes have their greatest impact in more advantaged and stable environments. This point is consistent with Drillien's research (1957) on the relationship between infants with low birthweight and their mothers' responsiveness. Middle-class parents are more apt to possess and exhibit the knowledge and skills they wish their children to acquire. They also have greater access to resources and opportunities outside the family that can provide needed experiences for their children (Bronfenbrenner & Morris, 2006). Parents from the middle class become more involved in children's schools.

The bioecological model draws on the involvement of family, school, and community and emphasizes stability, consistency, and predictability over time in these systems. In addition, it points to the critical role of parent involvement in school. For example, Bronfenbrenner suggested that Head Start should encourage parents to get involved and create a community because the lasting constructive impact of early intervention relies on its influence not only on the child himself but also on the family, neighborhood, and community. One of the earliest research programs in the field of education grew out of the "human ecology" theory of Bronfenbrenner (1979) and his associates (Cochran & Brassard, 1979; Cochran et al., 1990). Developed primarily to explain differences in child socialization and development, this theory emphasizes the importance of intergenerational linkages across a variety of social settings to the development of individual responsibility and cognitive development.

Cochran and his colleagues (1990) have pursued an ambitious, cross-national research agenda on several facets of Bronfenbrenner's theory. The children Cochran et al. (1990) examined were six-year olds, and the educational outcomes included teacher-reported school adjustment and grades. The main findings of their study supported the proposition that the intergenerational linkages mediated by institutions of education, neighborhood, and community organizations were beneficial for children.

Studies focusing on the influence of parent involvement on children's achievement acknowledge environmental variables advocated by Bronfenbrenner (1979). The bioecological model of human development suggests examining both the meso- and micro-system, which means research should include not only the time parents spent with their children at home (in micro-system) but also the contact and communication between parents and school in the meso-system. The bioecological theory is comprehensive in its exposition of predictors and outcomes of parent involvement (Epstein, 2007). Other theories and models (e.g., Coleman, 1988, Epstein, 1995; Hoover-Dempsey & Sandler, 1995, 1997) that have been applied to parent involvement studies are smaller in scope and thus only guide research on specific predictors of involvement. These more narrow theories might not be sufficient for explaining the relation between multiple predictors of parent involvement (e.g., parents' demographic and psychological characteristics) and children's academic outcomes (Epstein, 2007).

Epstein's parent-school partnership

Epstein (2001), a leading researcher in school, family, and community partnerships, defined parent involvement as "twelve techniques that teachers used to organize parental assistance at home, including reading, discussions, informal learning games, formal contracts, drill and practice of basic skills, and other monitoring or tutoring activities" (p. 181).She proposed a theory of four types of parent involvement in schools, including basic obligations, school-to-home communications, parent involvement at school, and parent involvement in learning activities at home (1987). This four-typed theory was modified and expanded to six types of parent involvement in schools, which consists of the following types (Epstein, 1995):

Type 1. Assist parents in child-rearing skills

Type 2. School-parent communication

Type 3. Involve parents in school volunteer opportunities

Type 4. Involve parents in home-based learning

Type 5. Involve parents in school decision-making

Type 6. Involve parents in school-community collaborations.

This typology provides schools with a structure to help organize specific activities in order to involve parents in their children's education. From Epstein's perspective, schools must choose which partnership practices are likely to produce specific goals and how to implement the selected activities effectively.

Many studies and measures have been conducted based on Epstein's theory. For example, McWayne et al. (2004) examined a multidimensional concept of parent involvement in kindergarten and investigated the relationship between parent involvement and children's social and academic competencies. In this study, parent involvement was assessed by the Parent Involvement in Children's Education Scale (PIES; Fantuzzo et al., 2002), which was founded on Epstein's (1987) categories of parent involvement and co-constructed with parents' and teachers' opinions. The results indicated that children with highly-involved parents were observed to have higher scores on the parent version of the Social Skills Rating System (SSRS). McWayne et al. believed that parents who play an active role in children's learning at home, contact the school regularly, and have more successful experiences for involvement have children who are reported as more cooperative and more engaged with their learning.

The theory of parent-school partnership clarified parent involvement behaviors from proximal home influences to the more distal community influences. It has well defined school-initiated behaviors and provided useful guidelines for getting parents involved in their children's education. Additionally, these broader influences involve parents participating in decision-making processes related to school governance and political issues that affect children. However, a valid conceptualization of parent involvement must account for the distinction between parent- and teacher-initiated behaviors because these two types of behaviors might yield both positive and negative outcomes in research studies (Kohl, Lengua, & McMahon, 2000).

<u>Hoover-Dempsey and Sadler's theoretical model of the parent involvement process</u>

One important issue concerning parent involvement in children's education addresses why parents choose to become involved and why their involvement can positively influence educational outcomes. In order to answer these questions, Hoover-Dempsey and Sandler (1995; 1997) proposed a theoretical model of the parent involvement process from a psychological perspective. The model of the parent involvement process was constructed in five sequential levels. The first level identified four psychological contributors to parents' basic involvement decisions (e.g., parental role construction, parental self-efficacy for helping the child, general school invitations for involvement, and general child invitations for involvement). Parental role construction refers to parents' beliefs about their roles and what they should do in children's education; parental self-efficacy is related to how much parents believe they can contribute to children's progress in school; general school invitations rely on opportunities or demands provided by children's schools; general child invitations come from children's invitation or asking for help.

The second level of this model hypothesized that once parents decide to become involved, parents' skill and knowledge, other demands on parents' time and energy, and specific invitations from the child and the school will influence parents' choice of involvement forms. The third level concerned mechanisms of parental involvement's influence on educational outcomes, such as modeling, reinforcement, and instruction. The fourth level presented the fit between parents' choice of involvement strategies and both the child's developmental level and the school's expectations. Then, the fifth level was students' performance in school.

Based on conceptual and empirical work to enhance understanding of processes, the model of parent involvement process was revised into a three-resource model through scale development (Walker et al., 2005). The first resource was parents' motivational beliefs, which consist of parental role construction and parental self-efficacy. Parents who experience success in parent involvement often hold an active role construction and believe that their involvement will help their children succeed in school. As a result, more positive parents' motivational beliefs will result in higher level of parent involvement.

The second resource was parents' perceptions of invitations for involvement from others. Hoover-Dempsey and Sandler considered invitations should include three types: general school invitations, specific teacher invitations, and specific child invitations. A general invitation from school is referring to the creation of a welcoming and responsive atmosphere. For example, a school always keeps parents informed about their children's progress, school events, and school requirements as well as respects and responds to parental questions and suggestions. A specific teacher invitation is relevant to the teacher's belief of parents' contributions to children's academic achievement, and its effectiveness has been reported in research about intervention programs. Requests or invitations from children also can increase parent involvement because parents generally want their children to succeed.

The third resource was parents' perceived life contexts. Hoover-Dempsey and Sandler (1997) believed that parents' perceptions of personal skills and knowledge shape their types of involvement, and parents' perceptions of other demands on their time and energy impact their participation in children's education. For instance, parents who feel more confident with their mathematics may be more likely to do math with their children than parents who do not. However, when parents need to spend more time making money in order to meet basic needs, they may be less involved than parents whose employment is relatively flexible.

The model of the parent involvement process was developed on the basis of empirical work and scale development. It provides a map to capture the process of how and why parents become involved in their children's education and also advocates for communication between families and schools. It is noticeable that this model assumes all levels build upon one another and this model is linear and unidirectional, which might not always be true. For example, parents might become less involved in helping with children's homework when their children outperform peers in school, or when parents believe that their children can do very well without help (Ng, Kenney-Benson, & Pomerantz, 2004). The model of the parent involvement process does not take into account the bidirectional nature of parents' beliefs, involvement, teachers' beliefs, and children's academic achievement, and it might fail to explain mixed findings of the association between parent beliefs and educational outcomes.

<u>The sociological perspective</u>

The fourth theoretical framework of parent involvement comes from a sociological perspective (e.g., Coleman, 1987; Cox & Witko, 2008; Hoffer & Shagle, 2003; Yan & Lin, 2005). It originated in Bourdieu's cultural capital theory (1977). Bourdieu proposed schools present and reproduce middle- and upper-class beliefs because most teachers come from these two SES backgrounds. Thus, teachers are more likely to communicate effectively with middle- and upper-class parents who share similar values of culture and expectations. It might result in ineffective communications between teachers and parents from the working class. Further, this process will promote the involvement of the middle- and the upper-class parents whereas it will limit parents with lower SES from getting involved in school activities.

Lareau (1987) extended Bourdieu's notion and identified four indicators of cultural capital which were related to parent involvement more directly. These indicators included the frequency of interactions a parent has with other parents, the frequency of parents' contact with school personnel, parents' understanding of school processes, and parents' communication skills. Lareau found that upper-class parents reported greater frequencies of these indicators of cultural capital and they were more likely to get involved in school, whereas working-class parents reported fewer and were less likely to become involved in school activities. Also, the finding indicated that teachers gave higher evaluations to students with highly involved parents, and as a result, the cultural capital influenced student achievement.

A similar construct termed social capital is also frequently mentioned in the literature. Coleman (1988) proposed an idea of social capital within the school context referring to social networks available to parents that enhance a student's ability through more educational opportunities. From Coleman's perspective, social capital in the family is the strength of the relationship between children and parents. If there is a strong relationship between children and parents, children benefit from social capital through the physical presence of parents in the family and the attention given by the parents to the child. In social capital theory, schools represent the value and the function of a community. People come together to share their beliefs in school where enforces adult norms and creates an intergenerational contact between parents and their children. Social capital theory takes into account the broader community and school context, and it has a powerful positive impact on education and children's welfare.

Studies founded on Coleman's theory conceptualized social capital in terms of parent involvement and measured family obligation, parent information network, and family norm as resources for parents to socialize their children's behaviors (e.g., Coleman, 1988; Fan & Chen, 2001). Family obligation refers to participation in Parent-Teacher Organization (PTO) activities, attending school programs, and discussing school topics (Hoffer & Shagle, 2003). Parent information networks are relevant to parents' contacts with school about children's performance, and knowing children's friends and their friends' parents. Family norms consist of parents' aspirations, family rules, and the relationship between parents and children. Parental resources affect children's educational outcomes by means of the socialization practice.

It is important to note that Coleman did not address parents' psychological characteristics, such as parents' aspirations and their perceptions of schools. There is evidence that parents' psychological characteristics influenced their decisions for involvement. Some investigators suggested that higher educational expectations for children may contribute to higher achievement levels (e.g., Goyette & Xie, 1999; Sue & Okazaki, 1990). Parents' beliefs and expectations about early education influence their education-related behaviors, which, in turn, influence children's achievement (Sy & Schulenberg, 2005). In addition, previous educational studies have indicated that parents' perceptions of school were associated with how much parents are involved in school

(Hill & Taylor, 2004; Overstreet et al., 2005). The social capital theory does not take into account the influence of parents' perceptions of school and parents' aspirations.

<u>Grolnick and Slowiaczek's parent involvement in school</u>

Grolnick and Slowiaczek (1994) suggested a multidimensional and motivational model of parent involvement in children's schooling, which integrates developmental and educational constructs and includes a general definition as well as specific dimensions. In this theoretical framework, parent involvement is defined as "the dedication of resources by the parent to the child within a given domain." Such a definition recognizes the influence of parents' values, time, and availability of resources provided by parents on their involvement in different activities. It indicates that parents may choose to, or be forced to, devote their time and energy to school, social activities, home activities, and athletics differently.

Grolnick and Slowiaczek proposed that parents' school involvement should include behavioral, cognitive/intellectual, and personal dimensions. Parents' behaviors are related to participation in school activities and helping with homework at home. Children can learn the importance of school via parents' behaviors and further, such behaviors may provide the parent with information so that he or she can help the child manage his/her learning (Baker & Stevenson, 1986). When parents show their high involvement in children's schooling, teachers will pay more attention to or give higher evaluations to their children. The second dimension is parents' cognitive/intellectual involvement. Activities and materials used for improving children's cognitive development are referred to parents' cognitive/intellectual involvement. Children benefit from practicing useful skills, become more familiar with learning in school, and improve their achievement. The third dimension, parents' personal involvement, is the child's aspiration regarding the school. When parents show their interests and concerns about the school, children will hold a positive attitude toward school education. Such positive interactions may help children feel more confident and perform well in school (Grolnick, Benjet, Kurowski, & Apostoleris, 1997; Gronlnick & Slowiaczek, 1994).

Grolnick and Slowiaczek's model expects that parent involvement affects the child through its impact on the child's attitudes and motivations related to school rather than directly targeting skill-building (Grolnick, Ryan, & Deci, 1991). In their study of parent involvement with predominantly Caucasian middle school students, results indicated that children's perceived competencies in scholastics and athletics mediated the relationship between parent involvement and school performance. These authors also concluded that factor analyses for this parent involvement measure were consistent with the three-dimensional model. However, there were two problematic factor loadings in personal and intellectual/cognitive dimensions.

Based on the information provided in the article, two regression coefficients of father's intellectual activities were higher than 0.4 (0.46 for the personal dimension and 0.56 for the intellectual/cognitive dimension, respectively). The authors decided this item should be categorized into the intellectual/cognitive dimension. The regression coefficients for parent-school interaction (child-report) were 0.46 for the personal dimension and 0.61 for the behavioral dimension, and finally this item was categorized into the behavioral dimension. Since these coefficients were not significantly different and the authors did not describe clearly the criteria for determining factor loadings, these two items might have an overlapping problem and it is not appropriate to evaluate this parent involvement measure based on the results of factor analyses only. In order to develop a better measure for assessing parent involvement, researchers should consider conducting other analysis methods or revising these items.

Multiple aspects of parent involvement

The theories and models discussed thus far have been used to examine parent involvement, but they are not independently sufficient for examining predictors of involvement, or the effects over time of parent involvement activities on children's academic outcomes or social behaviors (e.g., Fantuzzo, Tighe, & Childs, 2000). These theories and models borrowed and adopted Bronfenbrenner's bioecological model, but focused on specific components of parent involvement in order to investigate the expansion of the conceptualization of biological and environmental impacts on child development (Epstein, 2007). Some empirical research based on these models and theories has indicated several factors (e.g., SES or parent's educational level) could be used to explain or predict children's academic achievement (e.g., Feuerstein, 2001; Wong & Hughes, 2006; Yan & Lin, 2005). Other studies argued the positive relationship between parent involvement and child development due to statistically nonsignificant effects (e.g., Cox & Witko, 2008; Hoffer & Shagle, 2003; Wright & Beaver, 2005). These mixed findings might suggest that a specific component of parent involvement or the foci of several parental activities are not able to provide enough information for understanding the influence of parent involvement. Relying on only one theory or one model might fail to provide sufficient recommendations for strengthening home and school relationships and fostering broader involvement for educators, especially when working with families from diverse ethnic and cultural backgrounds.

Although the definition of parent involvement is chaotic, many researchers believed that parent involvement is a multi-dimensional concept (e.g., Caplan, 2001; Epstein, 1987; Grolnick & Slowiaczek, 1994; Sy, Rowley, & Schulenberg, 2007; Wong & Hughes, 2006). Therefore, in order to understand the portrait of parent involvement, it is necessary to include broader forms of parental behaviors. Miller, Zhang, Ani and Chen (2009) selected 15 articles published in peer-reviewed journals and conducted a comprehensive content analysis of family/parent involvement measures. Eight parental involvement domain categories were identified with 92 % final average inter-rater agreement. The eight domain categories included items that reflected: (1) Home--educational activities with a family member at home, (2) School--a family member participated in school events, (3) Communication between parents and the school, (4) Parents' aspirations, (5) Family rules, (6) Parental efficacy beliefs for helping children's educational activities, (7) Positive relations between the school and parents, and (8) Parent information network. Although these eight domains have covered most of the dimensions of parent involvement found in educational research, the relationship between these domains and children behaviors was not included. Thus, this study linked these eight domains and also investigated the factor of the relationship between parents and their children in order to determine optimal items of parent involvement from the ECLS-K dataset.

The Influence of Parent Involvement on Children's Schooling

Home involvement refers to parental interactions with the child at home (Reynolds, 1992), such as helping with children's homework, reading books, telling stories, singing songs, helping the child to do arts and crafts, involving the child in household chores, such as cooking, cleaning, setting the table, or caring for pets, playing games or doing puzzles with the child, talking about nature or doing science projects with the child, building something or playing with construction toys with the child, and playing a sport or exercise together (e.g., Kohl, Lengua, & McMahon, 2000; Reynolds, 1992; Sy & Schulenberg, 2005). Also, home involvement includes home time investment and the amount of reading and math activities at home, which are linked to children's performance at school.

Educators and researchers encourage parents to participate in their children's learning at home. These efforts are supported by part of the research that reports positive relationships between parent involvement at home and educational outcomes (e.g., Epstein, 1991; Epstein, Simon, & Salinas, 1997). For example, some studies suggested that the use of homework that requires parent-child interactions can create a line of communication between parents and teachers (Epstein, 2001), increase family involvement, and help improve student achievement (Epstein, Simon, & Salinas). Regarding students' mathematics performance, Ho and Willms (1996) reported that even after controlling for students' prior achievement, learning activities at home predicted higher student mathematics achievement in middle and high school. Sheldon and Epstein (2005) concluded that these results may reveal these types of interactions at home can help lessen the extent to which adolescents' transitions into middle school coincide with declines in academic motivation and achievement.

Although there is evidence that parent involvement at home has a positive association with students' achievement, some researchers disagreed with this conclusion. The analyses of the large datasets have revealed a negative relationship between parent involvement at home and students' reading and mathematics achievement. Milne et al. (1986) used data from the Sustaining Effects Study to assess whether parents helped with homework, and found a negative correlation between parent involvement and White elementary children's achievement. The findings drawn from the National Education Longitudinal Study of 1988 (NELS:88) dataset suggested the prediction of having parents who checked homework was negatively associated with students' mathematics, reading, and GPA across all races-ethnicities and income levels (e.g., Desimone, 2001; Singh et al., 1995). This counterintuitive finding is attributable to the fact that parents helped more if their children were not doing well at school. Another alternative hypothesis is that monitoring homework might hamper growth in maturity or the development of independence and responsibility which results in negative educational outcomes (Desimone). Therefore, the influence of parent involvement at home still merits educators' attention and needs further investigation.

Parent involvement in school consists of parents' behaviors aimed at supporting the child in school (Cronzier, 2007; Reynolds, 1992). This aspect is related to parents' intensive investment in the well-being of the school outcome in particular and the value of education in general. For instance, a parent or a member of the child's family shows his/her concern for the child via attending school activities, such as sports games, PTO/PTA, open house or back-to-school night, being a volunteer in school, and participating in fundraising for the child's school. Findings on parent involvement in school are mixed, ranging from no apparent effect (Muller, 1995) to statistically significant effects on children's academic achievement (Grolnick & Slowiaczek, 1994; Reynolds, 1992). For instance, a study that used data from NELS: 88 concluded that PTO involvement had little to do with children's science achievement (McNeal, 1999). Research concerning ethnicity indicated that Asian American parents were less involved in their children's school (Kim, 2002) and school involvement was not a significant predictor for Asian children's reading achievement (Lin, 2003).

Izzo et al. (1999) examined parents' participation in school activities and its influence on kindergarteners and third graders. These authors found that parent involvement in school positively predicted students' academic engagement. When parent involvement in school was examined within and between families, the results suggested that children with parents who were more involved in school activities held a more positive attitude toward schools, performed better on achievement tests, and showed less social behavioral problems in schools (Dearing, Kreider, Simpkins, &Weiss, 2006; McGrath & Kuriloff, 1999; Mcwayne, Hampton, Fantuzzo, Cohen & Sekino, 2004; Nord & West, 1998). These studies concluded that the positive relationship between parent involvement and child development lasts from kindergarten to adolescence (Fiese & Schwatz, 2008; Fulkerson, Neumark-Sztainer., & Story, 2006; Larson, 2008). These conflicting results suggest that the focus of parent involvement in school only might not provide enough information about parent involvement for predicting or understanding its influence on child development.

Communication between parents and schools refers to the amount of contact between the family and the school. Studies have showed that greater parent-teacher contact was associated with poorer performance in school because these contacts were primarily associated children's problematic behaviors in school (Izzo et al., 1999). Boys' parents contact school more frequently regarding their sons' behavioral problems at school. Studies comparing several ethnic groups have indicated that Caucasian American parents contacted the school more often when their children underperformed whereas Asian American parents reported fewer contacts across all grade levels (Desimone, 2001). It seems that communications between parents and schools are influenced by children's performance in school and their backgrounds.

Parents' aspirations termed as parent beliefs or educational expectations (e.g., Wu & Qi, 2005) have been measured by asking parents "How far in school do you expect the child to go?" or "The importance of skills, such as academic skills—counting to 20, knowing the letters of the alphabet, and using pencils--, or communications skills". The results of this literature are contradictory. For example, studies examining parent beliefs and children's achievement across whites, blacks, Hispanics, and Asian American groups showed that Asian American parents held significantly higher expectations for their children (Sy & Schulenberg, 2005; Wu & Qi, 2005). Researchers such as Goyette and Xie (1999) and Sue and Okazaki (1990) believed that Asian American parents' high aspirations contributed to their children's higher achievement. Regardless of racial or ethnic backgrounds, some studies concluded that higher expectations for children influence children's academic self-efficacy and translate into students' greater educational achievement (Sy, Rowley, & Schulenberg, 2007; Trusty, 2000; Yan & Lin, 2005), but others found that there was no significant relationship between parental expectations and children's achievement over time (Goldenberg et al., 2001). These inconsistent findings might suggest that parents' expectations and school participation are at least in part determined by their children's previous school performance (Englund et al., 2004; Shumow & Miller, 2001). There might be a bidirectional process between parental aspirations and educational outcomes, resulting in divergent findings in previous work (Englund, Luckner, Whaley, & Egeland, 2004).

Family rules include restrictions on TV, privileges, homework, and being with friends as well as after school supervision. Parents are asked how many hours the child may watch TV per day, the rule for maintaining grade average and for doing homework, limitations on privileges due to poor grades, and how much time the child spends after school each day at home with no adult present (e.g., Muller, 1995; Park & Bauer, 2002; Reynolds, 1992; Ho & Willms, 1996; Sy, Rowley, & Schulenberg, 2007; Trivette & Anderson, 1995). Coleman (1988) suggested that family rules do affect children's behavior and development, but educators have not known how this occurs (Yan & Lin, 2005). Singh et al. (1995) used a structural equation modeling approach to investigate the influence of parents' supervision on TV and homework and only found a very small negative effect on academic achievement. Similarly, in a meta-analytic study (Fan & Chen, 2001), the result showed the weakest relationship between family rules and academic achievement. Researchers still need to make efforts to understand the influence of family rules on child development.

Parental efficacy beliefs refer to parents' confidence in their help on children's homework, parents' views of their capability to help their children progress in school, and parents' confidence that they can have an impact on the school by participating in school governance (Eccles & Harold, 1993). Parental efficacy beliefs are measured by "I know/don't know how to help my child do well in school", "I feel successful about my efforts to help my child learn", or "I make a significant difference in my child's school performance" (Walker et al., 2005). Studies have revealed that parents who are confident with their abilities and knowledge for their children's learning, and who have less demands on their time for making money and more energy report greater parent involvement (Hoover-Dempsey et al., 2005). In addition, research investigating challenges to parent involvement in mathematics suggested that one obstacle for parents who are not able to be involved in their children's mathematics education is the parent's belief of his/her ability for helping homework. As mathematics becomes increasingly more complex across the school year, parents may not have the content knowledge or teaching skills needed to help their children (Gal & Stoudt, 1995).

A positive relationship between parents and schools is influenced by parents' knowledge that they are welcome in the school, that they are well informed about student learning and progress, and that school personnel respect them, their concerns, and their suggestions (Christenson, 2004). Hoover-Dempsey and Sandler (1997) proposed that invitations from the school serve as an important motivator of parent involvement because these invitations suggest to the parent that participation in the child's learning is welcome, valuable, and expected by the school and its members. Thus, children might be benefit from parent involvement in school as described previously. Positive relations are important to parental empowerment and involvement (Comer & Haynes, 1991).

Parent information network refers to sharing information outside the family. It is assessed by asking parents about their knowledge of children's friends and of their friends' parents (e.g., Muller, 1995; Ho & Willms, 1996; Yan & Lin, 2005). The literature suggests that the relationship between children's academic achievement and parent information network might vary by ethnicity (e.g., Yan & Lin, 2005). There is a positive association between students' academic achievement and parents' knowing children's friends and their parents for White, Black, and Hispanic families (Desimone, 2001; Yan & Lin, 2005).

Relevant Data Analytic Techniques

The primary data analytic techniques performed in this study were factor analysis including exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), item response theory (IRT), and latent growth modeling. Factor analysis and IRT were used to examine the first study objective in order to obtain a multidimensional picture of parent involvement. CFA and IRT were performed in order to validate the findings of EFA, and the results of CFA and IRT addressed appropriateness of the selection of items to assess parent involvement in the ECLS-K. Latent growth modeling using IRT-derived scores was used to address the second study objective, namely examining the association between the parent involvement domains and children's academic competencies.

<u>Factor Analysis.</u>

Kerlinger (1979) characterized factor analysis as "one of the most powerful methods yet for reducing variable complexity to greater simplicity" (p. 180). Given identified patterns of correlations, factor analysis provides information for determining how many underlying latent variables exist within a set of items and for determining an operational definition for latent construct of a measure through regression equations. Factor analytic methods provide a means of explaining variation among original variables, and assist researchers to define the substantive content or meaning of the factors that account for the variation among a larger set of items. Using either orthogonal or oblique rotation, factor analysis increases interpretability by identifying clusters of variables that can be characterized predominantly in terms of a single latent variable and provides an operational definition of latent construct in the basis of empirical data.

The two primary classes of factor analytic methods are exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA isolates factor structures without consideration of the theoretical expectations of the researcher, even when such expectations are available. On the contrary, CFA aims to validate hypothesized models which researchers must specify exactly. Researchers can extract factor structures using EFA for part of the data and next invoke a CFA for the other data in order to examine the model fit of the obtained structure from EFA (Thompson & Daniel, 1996).

EFA is intentionally designed to explore the number of unobservable (latent) variables of a set of items. EFA assumes that observed variables, sometimes termed items, can be represented by several latent variables. Before an EFA is used to determine how many factors to extract, the data should be screened for outliers and missing data. In addition, normally distributed variables make the solution of EFA stronger but are not strictly necessary. In this study, EFA was used to explore the underlying structure of selected items in the ECLS-K dataset for assessing parent involvement at the kindergarten wave. The result of EFA would suggest an underlying factor structure, which was initially defined as an eight-domain structure reviewed in previous paragraphs. Given the result of an EFA, a series of CFAs was used for examining the stability of the factor structure across kindergarten, first, third, and fifth grade.

CFA is a special case of structural equation modeling (SEM). It is used for testing whether proposed constructs influence observed variables. A CFA model includes indicators with unobserved errors and factors, and usually assumes that a latent construct can be measured by a set of observed indicators. Therefore, CFA is always theory–driven and the analysis starts with a theoretical model which specifies exactly the numbers of factors, observed variables (termed as indicators) loading on the factors, and the associations between factors. After a particular model is specified *a priori*, the researcher calculates and evaluates the model fit to the data. Sometimes the researcher goes further to find the most parsimonious model that fits the data.

CFA is often used with observed variables that are continuous, or interval, in nature. A standard CFA model has the following characteristics: (a) each indicator is assumed to be caused by one or more factors and an error term, (b) error terms are uncorrelated with the factors, and (c) all associations between factors are unanalyzed (Kline, 2005). Additionally, any kind of CFA model must meet these necessary and sufficient conditions in order to be identified: (a) the number of observations[1] must be greater than or equal to the number of free parameters, (b) the degrees of freedom must equal or be greater than zero, (c) one of the regression coefficients for each factor must be fixed to 1.0, and (d) multi-factor solutions must have at least two items per factor (Bollen, 1989; Kline).

Traditionally, CFA software uses maximum likelihood (ML) estimation methods to calculate the matrix of estimated correlations among the parameter estimates. ML estimation assumes multivariate normality for continuous indicators, and some researchers believe that this requirement is not ignorable (e.g., Bollen, 1989; McDonald, 1982). According to Kline (2005), for large sample sizes when the indicators are continuous but have severely nonnormal distributions, although ML parameter estimates are generally accurate, ML estimated standard errors tend to be 25-50% lower than for normally distributed data. This results in rejection of the null hypothesis that the population parameter is zero. Meanwhile, the value of the model chi-square tends to be too high so that true models will be rejected too often in exact fit tests (Chou & Bentler, 1995).

Although researchers in the SEM field proposed that ML cannot be used for dichotomous or ordinal data in CFA due to the violation of multivariate normality, some studies in the parent involvement area used CFA with the ML estimation method to examine the underlying factor structure of parent involvement. For example, Kohl et al. (2000) conducted CFA using the ML estimation method to investigate dimensions of the Parent-Teacher Involvement Questionnaire for parent- and teacher-reports. These authors reported that even though the data from the Parent-Teacher Involvement Questionnaire were ordinal, which violated the assumption of multivariate normality, there were negligible differences in the parameter estimates using regular versus scaled (robust) standard errors. This suggested that kurtosis indicating nonnormality did not result in a decrement in fit. As a result, they concluded that according to the results of CFA, the fit of the model was considered satisfactory and the construct of parent involvement consisted of six factors, which were Parent–Teacher Contact, Parent Involvement at School, Quality of Parent–Teacher Relationship, Teacher's Perception of Parent, Parent Involvement at Home, and Parent Endorsement of School. Wong and Hughes (2006) adapted twenty-six items from the Parent-Teacher Involvement Questionnaire for parent- and teacher-reports and added six additional items to assess parent involvement. They examined the model using EFA and CFA for two cohorts respectively, and the results indicated a four-factor solution had an adequate fit to the data. However, failure to use estimation methods that do not assume normality or corrected test statistics with ML may result in the rejection of correct models in favor of those with more factors (Kline, 2005). It means the results referring to the factor structure of parent involvement might be biased in these studies.

One way to avoid bias is to use the weighted least squares (WLS) estimation method to replace ML when dealing with either interval data which violates the assumption of normality or categorical/binary data (e.g., Muthén, 1984). The WLS estimation method generates asymptotic covariance matrices when there are both continuous and categorical indicators, or generates asymptotic correlation matrices when all indicators are categorical and it can provide estimates with very little bias and the lowest mean-squared error (Rigdon & Ferguson, 1991). Since items in the ECLS-K dataset combined with dichotomous, polytomous, and continuous responses, this study will use the WLS estimation method to investigate the factor structure of parent involvement, and it will be an improvement compared to previous research that used the ML estimation method to examine the construct of parent involvement.

Item Response Theory (IRT)

An alternative to CFA for item-level analyses is the generation of item characteristic curves (ICC) according to item-response theory (IRT) (Kline, 2005). It was proposed to overcome the limitations of CT, which is highly dependent upon the characteristics of sampled group, and which assumes an observed score is the result of the respondent's true score plus error. That error is not differentiated into subcategories, such as differences across time, settings, or items. Instead, IRT methods differentiate error more finely, particularly with respect to item characteristics, and assume sample-free. These characteristics allow a researcher to assess item performance and to develop a measure, which can be administrated across diverse groups. Additionally, IRT approaches can transform categorical data to interval data for other data analysis. Usage of IRT in this study is an improvement in identifying items to assess parent involvement and in examining the impact of its impact on children's academic achievement.

Item response theory is a statistical theory which results in separation of parameters for item characteristics and person abilities (Glas, 2005) in order to understand the examinee's underlying ability expressed as a correct response to an item on a test. An ICC is a plot of candidates' ability and the probability of correctly answering the question, and it is assumed to be a nonlinear model with an S-shaped curve describing the relationship between the probability of response to an item and the latent trait. From the IRT perspective, items are characterized as differing from one another with respect to item difficulty and item discrimination. Take, for example, the three-parameter logistic model (3PL) for dichotomous responses. It is estimated by

$$P_i(\theta) = c_i + (1 - c_i)\frac{e^{D_{a_i}(\theta - b_i)}}{1 + e^{D_{a_i}(\theta - b_i)}} \qquad (1)$$

where $P_i(\theta)$ is the probability that examinee i respond to item correctly;

θ is the ability of examinee i;

a indicates the item discrimination;

b presents the item difficulty;

c is the pseudo-guessing parameter for detecting if a correct response reflects examinee's guessing, not ability

When the parameter c is omitted, or fixed at 0, the 3PL model becomes the two-parameter logistic (2PL) model. If a constant discrimination parameter for all items is assumed, the 3PL further simplifies into the 1PL (or Rasch) model.

For conventional IRT models, there are two important assumptions: unidimensionality and local independence. Unidimensionality assumes that a single latent trait is sufficient to account for the examinee's performance (Hambleton, Swaminathan, & Rogers, 1991). It can be checked using the Winsteps software (Linacre, 2007). Unidimensionality is examined by the overall fit assessed through unweighted (outfit) and weighted (infit) mean squares (MNSQs). The expected values of MNSQs are 1.0 and for standardized fit (ZSTD) are 0.0 for both weighted and unweighted fit statistics. Information from a principal components analysis of residuals will be used for checking the assumption of unidimensionality as well. The expected variance explained by measures is more than 60%; the eigenvalue for unexplained variance in the first contrast should be less than 3, and the unexplained variance should be less than 5% (Linacre, 2007). However, since the assumption of unidimensionality "cannot be strictly met because several cognitive, personality, and test-taking factors always affect test performance, at least to some extent" (Hambleton, Swaminathan, & Rogers, 1991, p.9), it is recommended that a researcher conduct an exploratory factor analysis with the principal axis factoring extraction method to determine if a "dominant" component or factor that influences test performance (Hambleton et al.).

Local independence means that the examinee's responses to different items in a test are statistically independent. That is, the performance on one item doesn't affect the performance on another, and a test taker's response is a function of only his or her level of latent trait. The assumption of local independence, where item parameters in IRT are derived based on the estimated latent trait, make the information obtained from one sample using IRT models equivalent to that obtained from another sample. This "sample-free" characteristic is the major advantage of using IRT models.

In IRT, invariance needs to be tested if there are subgroups in a study, such as females and males, or public and private schools. Invariance can be checked using statistical significance tests, including t-tests, the Mantel-Haentsel test, the difference of logit position (differences should be smaller than 0.5 in order to meet invariance), and the correlation of item (or person) position across calibrations. These statistical methods are available in the Winsteps software (Linacre, 2007) and with other statistical packages.

Bock and Aitkin (1981) proposed the marginal maximum likelihood (MML) procedure can be used for estimating item parameters in IRT models. This procedure assumes that persons have θ vectors that are sampled from a population where the distribution of θ is given by the multivariate density function g(θ;α). g(θ;α) is the corresponding distribution function, and αindicates a vector of parameters that characterize the distribution. In the MML procedure, the EM algorithm is used to integrate the person parameters in order to obtain consistent estimates of the item parameters. The item parameters as then treated as known and fixed at their calibrated values, and estimates of ability parameters can be obtained (see Hambleton & Swaminathan, 1985, and Hambleton, Swaminathan, & Rogers, 1991, for details).

Reckase (1985) proposed multidimensional item response theory (MIRT) as an extension of IRT. A MIRT model is used for checking the item-examinee interaction when data do not satisfy the unidimensionality assumption (Ackerman, 1994). The MIRT specifies the structure and the relationship between persons and items within multiple traits and the analysis of the MIRT is essentially confirmatory in nature, where items are pre-assigned to dimensions based on some theoretically grounded hypotheses. In 1997, Reckase extended the 3PL model to a multidimensional context given by

$$P(X_{ij} = 1 | \theta_i, a_j, b_j, c_j) = c_j + (1 - c_i) \frac{\exp(a_j \theta_i + b_j)}{1 + \exp(a_j \theta_i + b_j)} \quad (2)$$

where $P(X_{ij} = 1 | \theta_i, a_j, b_j, c_j)$ is the probability of examinee i responding to item j correctly;

θ_i is a vector of abilities for examinee i;

a_j is a vector of parameters related to the discriminating power of the item;

b_j is a parameter related to the difficulty of a item, but it is different from the b_j in the 3PL model; and all other parameter are the same as in Equation (1).

A general form of the MIRT analysis is the multidimensional random coefficient multinomial logit model (MRCMLM). This model assumes between-item dimensionality where each item belongs to single latent dimension only so that different dimensions contain different items (Adams, Wilson, & Wang, 1997). (Complete explanations and examples of its use have been described in Adams et al.) This model is available in the ConQuest software 2.0 (Wu, Adams, Wilson, & Haldane, 2007). Since this study hypothesizes the construct of parent involvement consists of seven domains and each item represents only one underlying latent function, the researcher will employ the ConQuest software using marginal maximum likelihood to estimate regression coefficients, the variance-covariance matrix, and item parameter vectors in order to understand the construct of parent involvement in the ECLS-K dataset.

AIC and BIC are widely used to assess the goodness of model fit in MIRT. These two criteria are defined as (Kang & Cohen, 2007):

$$AIC = d + 2p \tag{3}$$

$$BIC = d + p * \log(n) \tag{4}$$

Where d is deviance;

p is the number of free parameters;

n is the sample size.

A model with a smaller value of ACI or BIC is considered as a better model. Om addition, researchers can use the information of AIC or BIC to compare the relative fit of different models using a likelihood ratio chi-squared statistics, which is given by:

$$\chi^2_{AIC} = AIC_{simple} - AIC_{complex} \tag{5}$$

$$\chi^2_{BIC} = BIC_{simple} - BIC_{complex} \tag{6}$$

Since the chi-square difference test is sensitive to sample size, the AIC proportionality constant (AIC_{pc}) and the BIC proportionality constant (BIC_{pc}) are calculated and that takes sample size into account:

$$AIC_{pc} = AIC/df \tag{7}$$

$$BIC_{pc} = BIC/df \tag{8}$$

A better-fit model has a lower value of AIC_{pc} and BIC_{pc}. Also, this study would use Root Mean Square Error of Approximation (RMSEA; Browne & Cudeck, 1993) for determining the goodness of model fit. RMSEA is not affected by sample size and it does not require the use of a comparison model. An ideal value of RMSEA is less than 0.05 (Browne & Cudeck) and it is calculated by (Kline, 2005):

$$\hat{\delta}_M = \max(\chi^2_M - df_M, 0) \tag{9}$$

$$\text{RMSEA}=\sqrt{\frac{\hat{\delta}_M}{df_M\,(N-1)}} \tag{10}$$

where the parameter δ is estimated as the difference between χ_M^2 and df_M or zero;

N is sample size.

Item fit of IRT models is checked through the unweighted (outfit) and the weighted (infit) mean square errors (MNSQs) as well as the weighted t and the unweighted t. The weighted and unweighted t are standardized forms of the weighted and unweighted MNSQ, where are transformed to take into account the size of the sample (Bond & Fox, 2001). While the expected value of MNSQs is 1.0, values between 0.6 and 1.4 are generally regarded as acceptable (Bond & Fox). T values between -2 and +2 indicate items that are routinely accepted. Additionally, Wilson (2005) suggested that when working with large sample sizes, a researcher should use both the weighted MNSQ and t statistics to determine item fit. Since this study includes over ten thousand participants at each data analysis wave, the researcher will use the information of the weighted MNSQ and t statistics to determine item fit based on Wilson's suggestions.

The MIRT model has been used for examining achievement tasks, including TIMSS, PISA, ACT assessment Mathematics Usage Test, and GRE (e.g., Ackerman, 1994; Kingston & McKinley, 1988; Wu & Adams, 2006). These studies have indicated that improved mathematical modeling and estimation methods in IRT aiming at extracting more information from existing data, particularly with multidimensional modeling, are continually improving the efficiency of assessments (e.g., Adams, Wilson, & Wang, 1997; Embretson, 1991; Wang, 1998). The multidimensional IRT provides better insight into what items are measuring (Ackerman, 1994) and it is a powerful tool for exacting information from a limited number of item responses (Wu & Adams). Since the construct of parent involvement is multidimensional, this study proposed to use the MIRT analysis for better understanding the dimensional structure of parent involvement.

Latent Growth Modeling

Most of the applications of SEM have concerned variables measured once or at most twice. A latent growth model is an extension of the SEM framework in order to study variables measured on at least three occasions. This analytic method examines the development of individuals on one or more outcome variables over time, and it does not require each participant to be assessed on the same number of time points. These outcome variables can be continuous latent variables or observed variables, including continuous, binary, ordinal, or combinations of different types of variables. Since sometimes the change over time is nonlinear and individual differences may covary with factors, latent growth models can be used to evaluate nonlinear changes in group means, individual differences in growth trajectories, and the prediction of these differences with other variables (Kline, 2005). This study assumed that domains of parent involvement have various strengthen in predicting children’s academic achievement from kindergarten to fifth grade, but students’ academic performance was not available at all data analysis time point. Given the characteristics of latent growth models which permit the estimation of models of change and prediction that include initial status, linear, or higher-order terms, and which does not require no missing data, the usage of latent growth modeling provided unbiased estimation of predictive strength of parent involvement domains on children’s learning over time.

The purpose of the present study was to explore the longitudinal construct stability of parent involvement measure as well as its impact on children's learning using the ECLS-K dataset. Parent involvement is defined as a multi-dimensional concept referring to parents' efforts for helping their children succeed in school. Due to the limited items included in the ECLS-K dataset, items for assessing parental efficacy beliefs are not available. Thus, the concept of parent involvement in this study consisted of seven potential domain categories: home, school, communication between parents and the school, parents' aspirations, family rules, parental information network and relations between schools and families. The hypotheses were that the results of a CFA and a multidimensional IRT would indicate a good model fit across data analysis time points, and that these two methods would yield very similar results for categorizing items into parent involvement domains and validate the idea of multiple aspects of parent involvement. The second study objective was to examine the relationship between parent involvement dimensions and children's academic achievement using both multiple regression and latent growth modeling. It was hypothesized that different domains of parent involvement would have different predictive strengths at a specific time point, and these domains have longitudinal influence on children's progress in their reading and mathematics.

CHAPTER II

Methods

This chapter started with the procedures describing variables in the ECLS-K dataset used in this study and expert reviews. Following the procedures, the data from ECLS-K dataset and participants in this study were discussed. Lastly, data analyses including EFA, CFA, and IRT approaches were provided.

Procedure

This study used the secondary data file (ECLS-kindergarten to fifth grade). Data included demographic variables and items of parent reports involving parent involvement. Demographic variables used in this study were background information of children and their parents that include gender, age, and family characteristics, such as income and ethnicity. By design, the ECLS-K dataset represents the distribution of ethnic groups in the national population, where 55.4 % of the children are European-Americans, 17.8 % Hispanic, 15.1% African-Americans, 6.4% Asian-Americans, and 5.3% others. Given the scope of the study it was possible to explore components of parent involvement in the United States.

Original data in ECLS-K were collected since the fall of 1998 when children entered kindergarten. The field supervisor contacted the school coordinator to schedule dates for children direct assessment, to verify parent consent procedures, and to link children to teachers. During the pre-assessment contact for the following waves, the field supervisor also collected locating information for sampled children who were no longer in the school, identified students' regular or special education teacher, and reviewed parental consent status (NCES, 2001). After obtaining consent from schools and parents, trained-assessors administrated direct children assessment in schools using CAI whereas conducted parent/guardian interviews by telephone. The same procedure was followed in each round of data collection.

The ECLS-K data are released in public-use and restricted-use versions. Released data include the Base Year (kindergarten year), First Grade, the Longitudinal Kindergarten - First Grade, the Third Grade, the Longitudinal Kindergarten through Third Grade, the Fifth Grade, and the Longitudinal Kindergarten through Fifth Grade data files, and they are available in both public-use and restricted-use files. Restricted data contain confidential information about children, their families, and their schools. Due to NCES' confidentiality legislation, it is required to obtain (or amend) a restricted data license to access restricted data from the ECLS-K. Since this study focused on the general condition of parent involvement in the U.S. and did not use sensitive information about children and their families, the data for this study were drawn from released data for public use.

An expert panel was enlisted to review all chosen items. The main purpose of expert review was to provide evidence of item sampling adequacy. The researcher sent out emails to invite school psychologists working with children and their families and professors who have published articles in the parent involvement are and. The research received responses from five experts who agreed to serve as expert panels, and four of them completed a survey rating appropriateness. Each of the five expert reviewers was sent an electronic file with an information sheet and an evaluation table of 25 items.

Definitions of parent involvement domains were attached in the file. This survey asked if an item was categorized appropriately into a specific domain and experts answered 1 to present very inappropriate and 5 to present very appropriate. Also, experts provided their comments for each item or the whole set of items if they had any concerns and then emailed back. After items were rated, the inter-rater agreement was calculated. Additionally, experts' comments were carefully read and used for guiding the following data analysis.

Data

This study drew data from the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) dataset, sponsored by the U.S. Department of Education, National Center for Education Statistics (NCES). The ECLS-K data were gathered by Westat with assistance from the Survey Research Center, the School of Education at the University of Michigan, and the Educational Testing Service (ETS). The purpose of ECLS-K was to provide information about children's academic achievement, social development, and the environments where children live and learn. The data in ECLS-K consist of information about the children's neighborhoods, families, schools, and classrooms, and the information resources include parents, teachers, school administrators, and the children themselves (Love, Meckstroth, & Sprachman, 1997). The ECLS-K was designed to provide comprehensive and reliable data that can be used to describe and to understand better children's development and experiences in the elementary and middle school grades, as well as how their early experiences relate to their later development, learning, and experiences in school. The multifaceted data collected across the years allow researchers and policymakers to study how various child, home, classroom, school, and community factors at various points in the child's life relate to cognitive and social development. The ECLS-K is not only the first one longitudinal study which had followed a cohort of children from kindergarten entry to middle school but also the most extensive, complete longitudinal databases for researchers to investigate children's development in early childhood.

The ECLS-K is the latest longitudinal study representing U.S. children, their family, and their environments. Participants were from a nationally representative cohort of kindergarteners. These children attended half or full day kindergarten programs in public or private schools in the fall and spring of the 1998-1999 school year. Data were collected from kindergarten through middle school. A total of 21,260 children and their families enrolled in 995 schools nationwide in the United States were initially sampled for this study. In the 1999-2000 school year, a 30 percent subsample of schools participated in the fall-first grade wave. In the 2000 Spring, data collection included all children assessed during the 1998-1999 school year, and children who were not in the kindergarten in the United States during 1998 to 1999 were added to the spring-first grade sample. Two more waves of data were collected in the spring of 2002 (third grade) and the spring of 2004 (fifth grade). The study did not recruit new students into these two waves after the first-grade year. Thus, estimates from the ECLS-K third- and fifth-grade data are representative of the population cohort rather than all third-graders in 2001-02, or all fifth-graders in 2003-04. The ECLS-K data includes seven waves so far: Fall of 1998 (base year), Spring of 1999 (base year), Fall of 1999 (first grade), Spring of 2000 (first grade), Spring of 2002 (third grade), Spring of 2004 (fifth grade) and Spring of

2007 (eighth grade). Since this study aimed at understanding parent involvement in early childhood, the eighth-grade data were not included in this study.

Sample selections for the ECLS-K involved a dual-frame, multistage sampling design. At the first stage, 100 primary sampling units (PSUs) were selected from a national sample of PSUs comprised of counties and county groups. At the second stage, public schools were selected within the PSUs from the Common Core of Data (a public school frame) and private schools were selected from the Private School Survey. Finally, two independent sampling strata were formed within each sampled school, one containing Asian and Pacific Islanders (APIs) and the second, all other students. Within each stratum, students were selected using equal probability systematic sampling with twins being sampled as a unit rather than as individuals. In general, each selected school sampled 24 children. Once the sampled children were identified, parent contact information was obtained from the school to invite parents to participate in this study.

The ECLS-K data were weighted to compensate for differential probabilities of selection at each sampling stage and to adjust for the effects of nonresponse. Weighting variables included three types: child-, teachers-, and school-level weights. While it is straightforward to use school- and teacher-level weights to produce school- and teacher-level estimates, several sets of child-level weights were computed for each data collection wave and for children with complete data from the combination of different data collection waves (termed longitudinal weights). It is noticeable that weights for parent interview were categorized into child-level weights since children's information was collected through the parent interview. Careful consideration should be given to the choice of a child-level weight in the basis of the type of data analyzed.

The survey instruments used in the ECLS-K include parent interviews, direct child assessments, teacher questionnaires, administrator questionnaires, and school facilities checklists. Teachers and school administrators were contacted in their schools and asked to complete self-administered questionnaires. Field staff completed the school facilities checklist. The parent interview was conducted over the telephone using computer-assisted interviewing (CAI). Trained evaluators administered assessments to measure children's socioemotional, cognitive, and physical development using both hard-copy instruments and computer-assisted interviewing (CAI). Details of reliability and validity of assessments are provided in the users' manual.

The design of the ECLS-K reflected a framework of child development which emphasizes the interrelationships among the child, the family, school, and community. The study has paid particular attention to and recognized the impact of parents and families in helping children adjust to formal school and in supporting their education through the elementary and middle grades (the User's Manual for the ECLS-K First Grade Public-Use Data Files and Electronic Codebook, NCES 2002-135). Key topics, such as parent's involvement with child's school, home environment and cognitive stimulation related to children's learning, parental educational expectations for child, and the interaction between parent and child, were covered in parent interview in most rounds. The ECLS-K provides rich data that enable researchers to explore parent involvement and its longitudinal influence from kindergarten to later elementary school performance. Therefore, this study benefits from insights gained through analyses of data for the large-scale, nationally representative ECLS-K data and the study's longitudinal design.

Participants

The data for this study were drawn from the Early Childhood Longitudinal Study Kindergarten Cohort (ECLS-K). The database includes seven waves as of 2009: Fall of 1998 (base year, kindergarten), Spring of 1999 (base year, kindergarten), Fall of 1999 (first grade), Spring of 2000 (first grade), Spring of 2002 (third grade), Spring of 2004 (fifth grade) and Spring of 2007 (eighth grade). Since at the third wave in the fall of 1999 only one third of participants were sampled, information from the third wave was not included in this study. Additionally, when two waves were available for the same academic year, this study combined information from the fall and spring to ease the data analysis. Since the focused period of the study was from kindergarten through elementary school years, four waves were used: the base year (Fall of 1998 and Spring of 1999), the first year (Spring of 2000), the third year (Spring of 2002), and the fifth year (Spring of 2004).

Parents. The target sample for the current study was all parents who provided complete responses for all chosen items in the parent interview questionnaire in each academic year respectively. This yielded four time points with various numbers of the total sample. At the kindergarten wave (in Fall of 1998 and Spring of 1999), 21,260 parents participated in interviews, but only 16,451 completed data for all chosen items and 4,809 provided incomplete data. At the first-year wave (in the Spring of 2000), 17,487 parents responded to the survey, and 15,311 of them answered all chosen items whereas 2,176 parents did not provide all information. At the third-year wave, the total sample of parents' report was 15,305 but only 12,836 completed data and 2,469 provided incomplete responses. At the fifth-year wave, 11,820 parents were involved in this study and 10,788 of them answered all chosen questions whereas 1,032 of them did not provide all information. Table 1 provides the information of sample size for the completed and incomplete data at each wave.

Children. In regard to children's information, the kindergarten wave includes 10,866 boys and 10,311 girls. At the first-year wave, 8,531 female and 8,945 male students were involved. At the third-year wave, 7,807 boys and 7,498 girls are included in this study. At the fifth-year wave, the information from 5,987 male and 5,833 female students was available for this study. Table 2 provides details of children's age and gender at each data analysis wave.

Table 1

Sample Size for the Completed and the Incomplete Groups by Wave

	Completed	**Incomplete**	**Total**
Kindergarten wave	16,451	4,809	21,260
First-year wave	15,311	2,176	17,487
Third-year wave	12,836	2,469	15,305
Fifth-year wave	10,788	1,032	11,820

Table 2

Sample Size and Mean Age of Children by Wave and Gender

	Sample size	Mean age (in months)	SD
Kindergarten wave			
Female	10311	68.11	4.17
Male	10866	68.77	4.45
First-year wave			
Female	8531	79.68	4.22
Male	8945	80.30	4.73
Not Ascertained	11		
Third-year wave		*	
Female	7498		
Male	7807		
Fifth-year wave		*	
Female	5833		
Male	5987		

*Children's age at the third and the fifth grade has been recoded into 5 categories in the Public-Use Data Files so that this table does not provide the information for the average age at these two time points.

Experts. The five experts reviewed the items and provided insights on the item selection. Four out of five experts were university professors, including one in an educational psychology program, one in an educational policy program, one in a school, family, and community program, and one in a curriculum and instruction program. The other expert is a school psychologist. These four professors have worked and published articles in the parent involvement area, and two of them used the ECLS-K dataset in their previous research. These experts are knowledgeable about parent involvement in child development as well as the ECLS-K dataset. Their opinions were used for content validation of the construct in this study.

Instruments

Parent measure. Parent interviews were conducted using a computer-assisted interview (CAI). Well-trained interviewers used a hard-copy questionnaire and then entered the answers into the CAI program. The primary language in which interviews were conducted in ECLS-K was English, but Spanish, Hmong, and Mandarin CAI instruments were also available. Only one parent for each child completed the parent questionnaire. The parent respondent was most often the mother, but parent respondents also included fathers, stepparents, adoptive parents, foster parents, grandparents, other relatives, or non-relative guardians. It was required that the respondent be at least 18 years old, be familiar with the child's education and care, and reside with the child (NCES, 2001).

Items of parent measures included information about children and their parents, such as family demographics (e.g., age, education, race/ ethnicity), family structure, depression ratings, and parent involvement with the child's schooling. Questions included yes/no responses, open-ended items, and multi-point scales. This study used items from parent interviews that reflected: (1) Home--educational activities with a family member at home, (2) School--a family member participated in school events, (3) Communication between parents and the school, (4) Parents' aspirations, (5) Family rules, (6) Parent information network, and (7) the relationship between schools and families. After careful consideration, 25 relevant items were selected from the ECLS-K database to measure parent involvement for each wave. The selected items could be found in Appendix C.

Child assessment. One-on-one, untimed direct child assessments were administrated using CAI at all rounds of data collection. These assessments measured children's language and literacy (reading) and mathematical thinking from kindergarten to fifth grade, general knowledge (combined science and social studies) in kindergarten and first grade, and science in third and fifth grade. Also, children's socioemotional development was assessed using the Self-Description Questionnaire (SDQ) in the spring of 2002 (third grade) and in the spring of 2004 (fifth grade). Since the foci of the present study was students' academic development and science achievement scores were only available at third- and fifth-grade rounds, only reading and mathematical scores from kindergarten to the fifth grade were used to represent children's development in academic achievement from kindergarten through elementary school years.

Validity of the reading and mathematics assessments in the ECLS-K dataset was carefully examined. Test items of reading and mathematics were reviewed by elementary curriculum and content area experts and teachers for appropriateness of content and difficulty, and for sensitivity to minority concerns. Additionally, the construct validity of the reading and mathematics assessments was evaluated by the inclusion of the Woodcock-McGrew-Werder Mini-Battery of Achievement (MBA). Correlations were computed for the MBA scores and the ECLS-K scores (0.70 to 0.8). It was concluded MVA and ECLS-K measures measured closely related skills.

The scores used to describe children's performance on reading and mathematics achievement are number-right score, item response theory scaled score, and item cluster score. Number-right scores are counts of the raw number of items a child answered correctly; item cluster scores are simple counts of the number of right answers on small subsets of items linked to particular skills. The IRT scaled scores estimate children's performance on the whole set of assessment questions using the IRT procedure. IRT uses the pattern of right, wrong, and omitted responses to the items actually administered in a test, and takes into account the item difficulty, item discrimination, and "guess" of each item to place each child on a continuous ability scale. IRT can compensate for the possibility of a low ability student guessing several hard items correctly. The reliability of IRT scores ranged from .91 to .96 from kindergarten through the fifth grade. These numbers indicated that IRT scaled scores of reading and mathematics were reliable. In addition, IRT scaled scores make possible longitudinal measurement of gain in achievement over time. Therefore, this study used IRT scaled scores (not number-right or item cluster scores) in reading and mathematics as outcome variables to examine the predictive strengths of parent involvement domains on children's achievement from kindergarten to fifth grade.

Expert survey. The experts were asked to evaluate the categorization of questions using a five-point rating scale. Definitions of parent involvement domains were provided (Table 3), and the experts responded to "if the category of each item is appropriate" for 25 potential items, respectively. Also, the experts gave their comments about each item or the whole set of items if they had any concerns and questions. Appendix A is the information sheet for experts, and appendix B provides details of the evaluation table.

Table 3

Definitions of Seven Domains of Parent Involvement in this Study

Domains	Definitions
Home	Parental interactions with the child at home, and home time and resources investment which are linked to children's performance at school
School	Parents' behaviors aim at supporting the child in school. It is related to parents' intensive investment in the well-being of the school outcome in particular and the value of education in general.
Communication between schools and parents	The amount of contact between the family and the school
Parent's aspiration	Parent beliefs or educational expectations for their children
Family rules	Restrictions on TV, privileges, homework and being with friends and after school supervision
Relation between parents and schools	Parents' knowledge that they are welcome in the school, that they are well informed about student learning and progress, and that school personnel respect them, their concerns, and their suggestions.
Networking	Sharing information outside the family

Data Analysis

Attrition analysis was to gauge the extent of the impact of incomplete data at four waves using SPSS version 17.0. A series of frequency analyses were performed for each wave. Since the study objective was to investigate optimal items of parent involvement from the parents' perspective, full information from the parents' report is needed. Therefore, participants were categorized into data-completed and incomplete groups according to the missing data on items regarding parent involvement from the parents' report. The completed group was the focus of this study. Following the categorization, the researcher compared demographic information for these two groups in order to check if the missing data is not related to parents' responses and they are ignorable.

The questions used in this study were eighteen binary questions, two open-ended questions, one six-point question, and four eight-point questions. In order to make response formats more consistent and each category in an item with approximately equal frequencies, the researcher recoded open-ended responses and polytomous responses. Item, “how many parents do you talk to regularly” was recoded into three categories, and “how many books does the child have?” was recoded into a five-point scale. Using SPSS 17.0, responses of each open-ended item were ranked from the lowest to the highest respectively. Regarding the responses for “how many parents do you talk to regularly”, around 36 % of parents responded 0, 13% of parents responded 1, 16 % of them chose 2, 12 % of them answered 3, 6 % of them answered 4, 6% of them chose 5, and around 10 % answered more than 6. Therefore, the original answer “0” stayed as 0, 1 and 2 were recoded to 1, higher than 3 was recoded to 2.Answers for having books ranked below 20 % were recoded to 0, ranked between 20% to 40% were 1, between 40% to 60% were 2, between 60 % and 80 % were 3, upper than 80 % were 4. Question, “How far in school do you expect your child to go?” was recoded from six points into three points. Responses including “receive less than a high school diploma”, “graduate from high school”, and “attend two or more years of college” were recode into 0. Responses, “finish a four-five college degree”, were 1; responses, either “master’s degree or equivalent” or “a Ph.D., MD, or other advanced degree”, were recoded as 2. Four eight-point questions, such as “How many days do you have breakfast/dinner with your child?”, and “How many days does your child have breakfast/dinner at a regular time?” were recoded into three-point scales. Refer to having breakfast at a regular time, answers less than two days were recoded into 0, three to six days were recoded into 1, and seven days were recoded into 3. For other eight-point questions, answers less than four days were recoded into 0, five to six days were 1, and seven days were 2.

In order to ensure accurate standard errors and parameter estimates, weights for adjusting for nonresponse, and cluster and strata information for adjusting design effects were selected for each data analysis wave after responses were recoded, For kindergarten wave, BYPW0 was the weight variable for adjusting parents who completely answered Home Environment Questionnaire in the fall of 1998 and the spring of 1999 while BYPWSTR and BYPWPSU provided cluster and strata information, respectively. The weight variable, C4PW0, the strata variable, C4TPWSTR, and the cluster variable, C4TPWPSU, were used for first-grade wave; the weight variable, C5PW0, the strata variable, C5TPWSTR, and the cluster variable, C5TPWPSU, were for third-grade wave; the weight variable, C6PW0, the strata variable, C6TPWSTR, and the cluster variable, C6TPWPSU, were for fifth-grade wave. The weight, strata, and cluster variables were used in factor analysis, and the weight variables were used in IRT approaches.

Next, this study explored the factor structure of parent involvement using exploratory factor analysis (EFA) followed by the multidimensional item response theory (MIRT) and confirmatory factor analysis (CFA). Then, a Rasch model was conducted to investigate the appropriateness of item. Following a Rasch model analysis, the researcher examined the influence of parent involvement on students' academic achievement at each data analysis wave using multiple regression. Variables, C1PW0, C1TPWSTR, and C1TPWPSU, were used for predicting students' academic achievement in the fall of 1998 (kindergarten-fall) predicted by parent involvement at kindergarten; C124PW0, C124TPWSTR, C124TPWPSU were weighting variables for predicting academic performance in the spring of 2000 (first grade), and parent involvement at first-grade wave was predictor controlling students' performance in the fall of 1998 (kindergarten-fall); at third-grade wave, the outcome was achievement in the spring of 2002 using parent involvement at third-grade as a predictor with a control of performance in the spring of 2000, and weighting variables were C45PW0, C45PPSU, and C45PSTR; at fifth-grade wave, parent involvement at fifth-grade wave was used to predict performance in the spring of 2004 controlling academic achievement in the spring of 2002, and C56PW0, C56PPSU, and C56PSTR were used. Finally, the researcher assessed the relationship between domains of parent involvement and children's performance in schools using latent growth modeling with a weight variable of C1_6FP0, a cluster variable of C16FPPSU, and a strata variable of C16FPSTR.

Part I: Expert Review

The expert panel reviewed 25 items and rated appropriateness of each item for the intended domain. The agreements for each item were listed, and items were sorted from very appropriate to very inappropriate. Experts' opinions regarding definitions for domains were supply materials for factor analysis and addressed in the discussion chapter.

Part II: Factor analysis

The factor structure of parent involvement in the kindergarten wave was explored using an EFA in Mplus. Since responses to each item were categorical and they failed to meet the assumption of multivariate normality, Mplus provides weighted least squares (WLS) to avoid bias for conducting EFA on categorical data (Muthén & Muthén, 1998-2007). Thus, the researcher used 10 % of data at the kindergarten wave using WLS in Mplus to conduct an EFA, with the original 25 items as indicators. The number of extracted factors was established in the basis of Mplus suggestions. After the number of factors was determined, the fit of each EFA models was considered using Root Mean Square Error of Approximation (RMSEA; Browne & Cudeck, 1994) that was less than 0.05. Factor loadings were checked using oblique rotation since factors were assumed to be correlated. Item loadings under 0.3 were eliminated as well as items that crossloaded on more than one factor. Also, every factor should contain at least three items. This process was repeated until all items loaded under only one factor with loadings greater than 0.3 and every factor contained at least three items.

Based on the results of EFA for the kindergarten wave, item fit to factors was tested for the other 90 % of data at the kindergarten wave, first-, third-and fifth-wave respectively using a CFA analysis in Mplus. Due to the violation of the assumption of normality, the variance-adjusted weighted least squares (WLSMV) in Mplus was used to adjust parameter estimates for data with a non-normal distribution (Muthén, 1993). Thus, the researcher performed CFA in Mplus using the WLSMV to examine goodness of model fit for one-, two-, and three-factor models.

The first step in the CFA analysis was to determine if the model was identified since only an identified model can be examined in a CFA analysis. An identified model is required to meet the following criteria: (a) the number of observations must be greater than or equal to the number of free parameters, (b) the degrees of freedom must equal or be greater than zero, (c) one of the regression coefficients for each factor must be fixed to 1.0, and (d) multi-factor solutions must have at least two items per factor. It was expected that a seven-factor model would be identified, and then, item fit of the model was examined.

Given the results of CFA, the researcher used fit indices, such as Root Mean Square Error of Approximation (RMSEA), and the Comparative Fit Index (CFI) to determine the fit of the model. The acceptable value for RMSEA value was less than 0.05 (Browne & Cudeck, 1993), and a CFI value greater than 0.9 (Hu & Bentler, 1999). If fit indices indicated model misfit, the researcher tried to collapse dimensions which were highly correlated with one another to begin with (based on the modification from Mplus output) and then modify the model until model fit was acceptable.

Factor Invariance Analyses. When the longitudinal factor structure of parent involvement was determined by CFA, a series of tests were conducted to establish that there is measurement invariance across four waves. The first step was a test for configural invariance, requiring that the same factors and pattern of factor loadings across four points of time (parameters were free to vary). This model was used as the baseline against other more restrictive models in the following invariance tests. Next a test of metric invariance was conducted to determine whether or not the values of the factor loadings of each variable on each factor were the same across each data analysis wave (Horn & McArdle, 1992). Subsequently, the researcher proceeded to test for scalar invariance, requiring the intercepts of the regression of the regression equations of the observed variables on the latent factors are equivalent across time. The last step involved a test of the equality of residual variances for each observed item across four waves. Since the chi-square value and degree of freedom for WLSMV cannot be used for chi-square difference tests (Muthén & Muthén, 1998-2007), CFI difference tests were computed between the invariance models using a cut-off for change of less than .01 (Hu & Bentler, 1990). Satisfying configural invariance was considered sufficient for concluding that invariance in the factor structure exists. When invariance cannot be established, the researcher would proceed with the test of a model that includes separate estimates of parameters for each wave to test partial invariance.

Part III: Item Response Theory (IRT)

The MIRT phase consisted of assessing the model given by the EFA analysis described previously. Item fit was checked through the unweighted MNSQs (Wilson, 2005). It was expected that the MNSQ of infit in the MIRT model would indicate an acceptable model fit and yield the same results as from the CFA. If the MIRT model failed to justify the CFA model, the researcher would go back to the recoding phase to establish a new category calibration, or try to create another multidimensional model for evaluating item fit.

Following the MIRT phase, the researcher conducted a series of Rasch analyses. Before the question of optimal items was addressed, the assumption of unidimensionality was checked for each domain using the Winsteps software (Linacre, 2007). Unidimensionality was examined by the overall fit assessed through the unweighted and weighted MNSQs and ZSTD as well as the information from a principal components analysis of residuals.

Following the test of unidimensionality, the first step was to check if items were widely dispersed. An adequate measure should have items which spread out in order to cover people's ability/agreement from low to high. The second step was determining the category structure. Since these responses of open-ended and polytomous items are artificially recoded in this study and it might be not the best way to categorize responses, observed average and structure calibration were examined. If both increase in order from category 1 to the higher category, then the scale is used appropriately. Then, the researcher examined item fit and person fit. Item fit was determined through MNSQs (INFIT and OUTFIT). The standards stated in the MIRT phase were applied here and the results were used for determining optimal items of parent involvement in ECLS-K dataset.

After items were obtained, the assumption of invariance was tested across children's gender in this study using the Winsteps software. This study assumed parents having a boy or a girl did not respond to the items differently. The assumption of invariance was checked using statistical significance tests, including t-tests and Mantel-Haentsel tests, the difference in logit position, and the correlation of item (or person) position across calibrations. It was expected that there would be no statistically significant differences in item position between these two groups.

The last step was to assess reliability. A reliability coefficient of .70 represents an acceptable level of reliability, .80 represents a good level, and .90 represents an excellent level (Duncan et al., 2003). Another reliability statistic called person separation is available in Winsteps. This statistic indicates how well the participants can be distinguished from one another and is based on the adjusted person standard deviation divided by the average measurement error (Bond & Fox, 2001). Person separation should be at least 1.0 for distinguishing people appropriately and 2.0 to indicate the measure is productive.

This study assumed the results at each step would indicate items that are stated and employed appropriately for assessing parent involvement. However, if findings failed to meet the criterion for each analysis, the researcher needed to modify the model and potentially rerun the analyses from the beginning until the results indicated an acceptable item fit for a final selection of items.

Given the results of CFA and MIRT, a Rasch procedure was applied to scale scores for each domain of parent involvement over time. These scaled scores of parent involvement and children's Rasch-scaled scores on reading and mathematics were used under the assumption of multivariate normality of the data. These scores were used for predicting children's reading and mathematics at each data analysis wave as well as for predicting children's progress in their reading and mathematics abilities.

Part IV: Multiple regression analyses

Multiple regression is a method that investigates the pattern among many variables (McMillan & Schumacher, 1997). It is a complex statistical procedure that allows the researcher to analyze and understand a complex situation by dealing with many variables simultaneously (Gay, 1987). This study assumed parent involvement is a multi-dimensional construct, and each domain has its unique influence on academic achievement. Therefore, in order to understand the association between each domain of parent involvement and children's achievement at a specific time point, the researcher conducted a series of multiple regression using AM (Hahs-Vaughn, 2005) to examine the influence of parent involvement on students' achievement at kindergarten-, first-, third, and fifth-grade wave, respectively.

Part V: Latent Growth Model (LGM)

These scaled scores of parent involvement and children's Rasch-scaled scores on reading and mathematics were used in a latent growth model in Mplus (Muthén & Muthén, 1998-2007) under the assumption of multivariate normality of the data. In order to adjust design effects and sampling problems, C1_6FP0 was used for person weights, and C16FPPSU and C16FPSTR were for cluster and strata variables. The analysis proceeded by assessing change in students' reading and mathematics scores across four time points in order to identify the growth models for reading and for mathematics abilities. Once the growth models were determined, domains of parent involvement at kindergarten were added into the growth models as predictors to examine the influence children's growth rate in reading and mathematical achievement.

The study aimed to assess the relationship between change in the parent involvement domain and change in children's academic achievement in reading and mathematics, respectively. This study assumed a linear growth curve model where the initial status of parent involvement was set at the kindergarten wave. Also, the initial status of children's performance was set in the fall of 1998. It was hypothesized that the results would indicate that the longitudinal impact of parent involvement on students' academic performance varied over time.

Chapter III

Results

This chapter addresses the data analysis results described in Chapter 2. Attrition analyses were examined for participants' characteristics in the completed group and the missing group in order to understand whether or not parents who answered all 25 items were different from parents who did not answer all questions in their children's ages, ethnicity, gender and family socioeconomic status. Expert reviews represented the content validity of 25 items and the appropriateness of categorization of each item for an intended domain. Both factor analysis and IRT approaches were used for investigating appropriate items to assess parent involvement from kindergarten through the fifth grade. The short-term influence of parent involvement was examined using multiple regression analyses. Lastly, children's progress in reading and mathematics examined through latent growth modeling. Once the growth rate of reading/mathematic achievement was determined, the researcher used the domains of parent involvement as predictors at kindergarten wave to examine the longitudinal impact on children's reading and mathematical progress.

Part I: Attrition Analyses

Before any substantial analysis, it was necessary to compare characteristics between respondents who answered all the selected items (named the completed group) and respondents who did not (termed the missing group) to investigate potential response bias. Therefore, the two groups were compared on children's age, gender, ethnicity, and family socioeconomic status (SES) at each of data analysis wave, respectively. Age differences were examined in SPSS via t-tests at kindergarten- and first-grade wave and via chi-square difference tests for third- and fifth-grade wave; the differences tests of gender, ethnicity, and family SES were accomplished by chi-square difference tests using SPSS.

Table 4

Tests for Ages (in months) Differences between the Missing and the Completed Groups

Variable	***N***	***Mean***	***SD***	***t***	***p***	***Cohen's d***
Kindergarten				2.163	0.031	-0.043
Missing	3078	68.25	4.47			
Completed	16,036	68.44	4.32			
First				-3.315	.001	-0.141
Missing	1968	86.41	6.51			
Completed	14,715	86.91	4.27			
Third				19.067*	0.004	
Missing	2417					
Completed	11,978					
Fifth				1.662*	.894	
Missing	815					
Completed	10,468					

Note. *Ages of third- and fifth-graders were presented as categories so that the means and SD were not available for these two waves in the Public-use File. Therefore, chi-square difference tests were performed.

Table 5

Valid Percents of Age Information (in Months) for the Missing and the Completed Groups at Third-grade Wave

Variable	***Not Ascertained***	***Less than 105***	***105 to less than 108***	***108 to less than 111***	***111 to less than 114***	***114 to less than 117***	***117 or More***
Third							
Missing	0.10	8.50	20.50	22.20	20.70	18.60	9.40
Completed	0.00	7.20	20.40	23.10	23.00	17.60	8.40

The results indicated that the average ages of children from two groups were statistically significantly different at kindergarten, first-grade, and third-grade wave (Table 4). For kindergarteners, the average age of the missing group (M=69.25) was higher than the average age of the completed group (M=68.44 month) (t=-2.163, *p*=.031, Cohen's d=-.043). For first graders, the average age for children in the missing group (M=86.41, SD=6.51) was less than children in the completed group (M=86.91, SD=4.27) (t=-3.315, *p*=0.001, Cohen's d=-0.141). Since the Cohen's d showed small effect size, the differences between two groups at kindergarten and first-grade waves were ignorable. For third-grade wave, the result of the chi-square difference test suggested a statistically significant between two groups ($\chi^2_{(513495)}$ =19.067, *p*=0.004). The completed group had more participants at the range of 111 months to less than 114 months (Table 5). For fifth graders, there were no statistically significant differences in age between two groups ($\chi^2_{(5,11283)}$ =1.662, *p*=.894) (Table 6).

Table 6

Valid Percents of Age Information (in Months) for the Missing and the Completed Groups at Fifth-Grade Waves

Variable	***Not Ascertained***	***110 to less than 126***	***126 to less than 132***	***132 to less than 138***	***138 to less than 144***	***144 to 166***
Fifth						
Missing	0.00	1.50	29.90	43.80	22.50	2.30
Completed	<0.001	1.20	29.40	45.60	21.50	2.30

Children's gender in the missing and the completed group displayed significant differences at kindergarten and first-grade wave ($\chi^2_{(1,21260)}$ =39.709, *p*<0.001 for kindergarten wave; $\chi^2_{(1,17487)}$ =46.245, *p*<0.001 for first-grade wave) because some children's gender in the missing group was unknown. Children's age at third- and fifth-grade wave did not show difference between two groups with chi-squares smaller than 3.01 and p values greater than 0.05. Table 7 provides information of the tests for gender differences.

Regarding the composites of ethnicity in two groups, the results of chi-square difference tests suggested significant differences across all data analysis waves (Table 8). The missing groups across waves contained more Asian, Hispanic, and Black, and fewer White Americans compared to the completed group across four waves.

Table 7

Chi-square Difference Tests of Gender between the Missing and the Completed Group

Variable	***Not Ascertained***	***Male***	***Female***	***Chi-square***	***p***
Kindergarten				39.71	<0.001
Missing	13	2515	2334		
Completed	0.00	8351	8047		
First				46.25	<0.001
Missing	11	1121	1044		
Completed	0.00	7824	7487		
Third				3.01	.083
Missing	0.00	1222	1252		
Completed	0.00	6585	6246		
Fifth				0.10	.752
Missing	0.00	413	411		
Completed	0.00	5574	5422		

Table 8

Summary of Valid Percents of Ethnicity Information for the Missing and the Completed Groups and Chi-square Differences Tests of Ethnicity

Variable	***White***	***Black***	***Hispanic***	***Asian***	***Others***[1]	***Chi-squares***	***p***
Kindergarten						388.098	<0.001
Missing	45.00	18.70	19.00	11.30	6.10		
Completed	58.3	14.00	17.30	5.00	5.40		
First						646.186	<0.001
Missing	32.90	21.60	24.50	14.70	6.30		
Completed	59.80	13.20	16.30	5.10	5.50		
Third						411.556	<0.001
Missing	40.00	20.10	22.20	12.30	5.40		
Completed	59.80	11.70	17.30	5.40	5.80		
Fifth						184.065	<0.001
Missing	36.80	21.50	22.50	13.30	5.90		
Completed	58.50	10.60	18.80	6.40	5.70		

1 Included Native Hawaiian, other Pacific Islander, American Indian or Alaska native, more than one race but not Hispanic, and not ascertained for ethnicity.

Referring to family SES, the results suggested statistically significant differences between two groups at the kindergarten and the first wave (both chi-squares>211.00, *p* values<0.001). It was found that the majority of the missing group came from the first quintile SES and with a lesser percentage of participants from the fifth quintile SES. However, the distributions of SES between two groups were not significantly different at third grade ($\chi^2_{(4,14395)}$ =8.712, *p*=0.069).At fifth-grade since only the SES data for the completed group were available, this study did not compare the difference of SES between two groups. The researcher also examined the completed group at kindergarten and third wave and found that the third wave consisted of more participants from the first and the fifth quintile ($\chi^2_{(4,27606)}$ =19.63, *p*<0.001). Table 9 provides the comparison of SES between the missing and the completed group at the kindergarten, first, and third wave.

Table 9

Summary of Valid Percents of SES information for the Missing and Completed Groups, and Chi-square Difference Tests of SES

Variable	*First Quintile*	*Second Quintile*	*Third Quintile*	*Fourth Quintile*	*Fifth Quintile*	*Chi-squares*	*p*
Kindergarten						232.384	<0.001
Missing	26.10	22.10	17.90	17.10	16.70		
Completed	17.00	18.70	21.00	21.30	22.80		
First						211.522	<0.001
Missing	34.80	22.90	17.60	15.60	9.10		
Completed	16.20	18.50	19.90	21.10	24.40		
Third						8.712	0.069
Missing	15.90	18.10	19.50	21.60	24.90		
Completed	19.30	15.80	19.50	19.00	26.40		

Part II: Expert Review

The researcher received feedback from five experts. Four out of five reviewed 25 items by rating and providing comments about the appropriateness of categorization of items and wording for intended domains. Also, these four experts made comments on definitions of parent involvement domains. The last expert did not rate the items and suggested using quantitative methods with a combination of factor analysis, correlational relationships, and face validity to determine if an item is appropriate for a domain or not. Therefore, the inter-rater agreement was calculated from the answers of four experts, not five.

Three experts on the panel suggested clarifying definitions of each domain of parent involvement used in this study. For the home involvement domain, one expert questioned the definition and wrote, “Do you mean investment of home-based time and resources in support of children’s learning?” One expert considered home involvement should include family routines because “family positive involvement and structure indicate investment in child and relate to positive outcomes.” In addition, one expert proposed that "items within home involvement are not about parent involvement at all, but are about what the child did/is doing – taking music lessons, etc. These items are used to assess the child's actions, schedules, choices even though some of them are involvement components (e.g., some require parents to pay for lessons, take time to transport children, some may be at school – after school hours, some may be free)". This expert suggested being cautious when interpreting items that are not directly about parent involvement.

Referring to school involvement, one expert suggested that this domain should be interpreted as "the value of education in general and the well-being of child's school, in particular." For the domain of communication between schools and families, one expert considered that simply referring to the amount of contact between the family and school seems insufficient. This expert suggested adding the quality of one-way versus two-way interactions. For networking, another expert wrote, "Sharing information about what? This child's progress in school? What do you mean by outside? Can you give examples to make this clearer? Do you mean social networking among families independent of school-established channels of communication?" For the domain of relation between parents and schools, an expert suggested using belief or perception rather than knowledge.

Experts were asked to rate 25 items using a five-point rating scale where 1=very inappropriate and 5= very appropriate. Average appropriateness ratings per item ranged from 3 to 5 when considering a single item's appropriateness for assessing an intended domain. It means each item was rated as moderate to high levels of agreement for appropriateness. When items were clustered within an intended domain, the overall average item-domain appropriateness for each domain ranged from 3.22 to 5: the mean for parents' aspirations, communication between schools and parents, relation between schools and parents, and school involvement was 5, networking was 4.75, home involvement was 4.36, and family routines was 3.22. The overall average item-domain mean accessing six domains was 4.62. All of the above average ratings were obtained using ratings from four expert reviewers.

Part III: Factor Analysis

The researcher conducted EFA using 10 percent of the data at the kindergarten wave (an initial sample of 1,621 cases; a weighted sample size of 372,902 cases) to explore the factor structure of parent involvement for 25 items in the ECLS-K dataset. The results in Mplus demonstrated that a two-, three-, or four-factor solution fit the data better than one-factor solution with RMESA less than 0.05. However, in the four-factor model the fourth factor loaded on only two items, and this study did not examine the goodness of model fits of the four-factor model in CFA and in MIRT. In addition, the researcher examined a one-factor model in order to justify a multidimensional construct of parent involvement. Table 10 presents the results of EFA. Table 11 and 12 provide information of factor loadings on two- and three-factor solutions respectively.

The researcher examined factor loadings using a cutoff of 0.3 and combined with the findings of expert review. Since experts rated 25 items as moderate to high levels of appropriateness and it means that these items could be used for assessing domains of parent involvement, items were retained if an item has a loading on one factor higher than 0.3 and did not crossload on more than one factor. Therefore, a one-factor model consisted of 25 initial items. For a two-factor solution, the first factor contained 16 items while the second factor contained 5 items. The total number of items in a two-factor model was 21. In a three-factor model, the first factor contained 12 items, the second contained 5 items, and the third factor included 3 items. After the structure of three models was determined, a series of CFA was conducted using Mplus (Muthén & Muthén, 1998-2007), and the model fit indices were obtained for these three models at the kindergarten-, first-, third-, and fifth-grade waves.

Table 10

Fit Indices for EFA

	One factor	Two factor	Three factor	Four factor
Chi-Square	1318.25	481.95	333.692	213.453
df	152	148	142	131
RMSEA	0.069	0.037	0.029	.020

Table 11

Exploratory Factor Analysis for the Two-factor Solution

ID	***Item Content***	***Abbreviation***	***Factor 1***	***Factor 2***
1	P1 PIQ030 HAVE YOU MET CHILD'S TEACHER	(P1)MTEACH	0.501	0.101
2*	P1 PIQ120 WHAT DEGREE EXPECTED OF CHILD	(P1)EXPECT	0.179	0.078
3*	P1 HEQ040 HOW MANY BOOKS CHILD HAS	(P2)PARINT	0.275	0.056
4	P2 PIQ110 PARENT CONTACTED SCHOOL	(P2)ATTENB	0.545	0.096
5	P2 PIQ130 ATTENDED OPEN HOUSE	(P2)ATTENP	0.391	0.039
6	P2 PIQ140 ATTENDED A PTA MEETING	(P2)PARGRP	0.354	0.133
7	P2 PIQ150 ATTENDED PARENT-TEACHER CONF	(P2)ATTENS	0.561	0.086
8	P2 PIQ160 ATTEND SCHOOL EVENT	(P2)VOLUNT	0.701	0.126
9	P2 PIQ170 ACTED AS SCH VOLUNTEER	(P2)FUNDRS	0.495	0.102
10*	P2 PIQ175 PARTICIPATED IN FUNDRAISING	(P2)NOTWEL	0.231	0.239
11	P2 PIQ450 NOT FEEL WELCOMED BY SCHOOL	(P2)LIBRAR	0.423	0.164
12	P2 HEQ100 VISITED THE LIBRARY	(P2)COMPWK	0.425	0.134
13	P2 HEQ230 FREQ CHILD USES COMPUTER	(P2)DANCE	0.412	-0.059
14	P2 HEQ300 TAKES DANCE LESSONS	(P2)ATHLET	0.567	0.063
15	P2 HEQ310 PARTCP IN ATHLETIC EVENTS	(P2)CLUB	0.421	-0.058
16	P2 HEQ320 PARTICP IN ORGANIZED CLUBS	(P2)MUSIC	0.381	0.024
17	P2 HEQ330 TAKES MUSIC LESSONS	(P2)ARTCRF	0.343	-0.049
18*	P2 HEQ350 TAKES ART LESSONS	(P2)ORGANZ	0.298	-0.106
19	P2 HEQ370 PARTCP IN ORGANIZED PERFORMING	(P2)BKTOG	0.123	0.414
20	P2 HEQ500 # DAYS EAT BREAKFAST TOGETHER	(P2)BKREG	0.123	0.456
21	P2 HEQ510 # DAYS CHD EAT BRKFST REG TIME	(P2)EVENG2	-0.260	0.678
22	P2 HEQ520 # DAYS EAT DINNER TOGETHER	(P2)EVENG	-0.205	0.843
23	P2 HEQ550 GO TO BED SAME TIME EACH NIGHT	(P2)GOTOBD	0.259	0.327
24	P4 HEQ020 HOW MANY BOOKS CHILD HAS	bOOK5	0.594	0.145
25	P2 PIQ300 # PARENTS TALK W/ REGULARLY	PARENT	0.500	0.125

Note: Two items, P2EVNG2 and P2EVENG, had negative factor loadings on factor 1; the items, P2DANCE, P2CLUB, P2ARTCRF, and P2ORGANZ had negative factor loadings on factor2
* Item 2, 3, 10, and 18 were delimitated due to factor loadings less than 0.30.

Table 12

Exploratory Factor Analysis for the Three-factor Solution

ID	Content	Abbreviation	Factor 1	Factor 2	Factor 3
1	P1 PIQ030 HAVE YOU MET CHILD'S TEACHER	(P1)MTEACH	0.431	0.286	0.065
2*	P1 PIQ120 WHAT DEGREE EXPECTED OF CHILD	(P1)EXPECT	0.136	0.152	0.071
3*	P2 PARENT CONTACTED SCHOOL	(P2)PARINT	0.283	0.054	0.017
4	P2 PIQ130 ATTENDED OPEN HOUSE	(P2)ATTENB	0.595	0.038	0.009
5	P2 PIQ140 ATTENDED A PTA MEETING	(P2)ATTENP	0.429	0.014	-0.027
6	P2 PIQ150 ATTENDED PARENT-TEACHER CONFERENCE	(P2)PARGRP	0.412	-0.018	0.071
7	P2 PIQ160 ATTEND SCHOOL EVENT	(P2)ATTENS	0.568	0.120	0.010
8	P2 PIQ170 ACTED AS SCH VOLUNTEER	(P2)VOLUNT	0.703	0.179	0.035
9	P2 PIQ175 PARTICIPATED IN FUNDRAISING	(P2)FUNDRS	0.498	0.120	0.037
10*	P2 PIQ450 NOT FEEL WELCOMED BY SCHOOL	(P2)NOTWEL	0.274	0.015	0.201
11	P2 HEQ100 VISITED THE LIBRARY	(P2)LIBRAR	0.419	0.162	0.116
12	P2 HEQ230 FREQ CHILD USES COMPUTER	(P2)COMPWK	0.435	0.098	0.079
13	P2 HEQ300 TAKES DANCE LESSONS	(P2)DANCE	0.097	0.745	0.004
14	P2 HEQ310 PARTCP IN ATHLETIC EVENTS	(P2)ATHLET	0.502	0.275	0.012
15	P2 HEQ320 PARTICP IN ORGANIZED CLUBS	(P2)CLUB	0.272	0.386	-0.062
16	P2 HEQ330 TAKES MUSIC LESSONS	(P2)MUSIC	0.136	0.584	0.077
17	P2 HEQ350 TAKES ART LESSONS	(P2)ARTCRF	0.147	0.464	-0.020
18	P2 HEQ370 PARTCP IN ORGANIZED PERFORMING	(P2)ORGANZ	-0.034	0.687	-0.032
19#	P2 HEQ500 # DAYS EAT BREAKFAST TOGETHER	(P2)BKTOG	0.307	0.102	0.381
20	P2 HEQ510 # DAYS CHD EAT BRKFST REG TIME	(P2)BKREG	0.141	0.096	0.451
21	P2 HEQ520 # DAYS EAT DINNER TOGETHER	(P2)EVENG2	-0.140	-0.155	0.69
22	P2 HEQ530 # DAYS EVENING MEAL REG TIME	(P2)EVENG	-0.097	-0.083	0.873
23*	P2 HEQ550 GO TO BED SAME TIME EACH NIGHT	(P2)GOTOBD	0.280	0.085	0.296
24	P4 HEQ020 HOW MANY BOOKS CHILD HAS	bOOK5	0.570	0.211	0.078
25	P2 PIQ300 # PARENTS TALK W/ REGULARLY	PARENT	0.476	0.188	0.071

Note: Three items, P2ORGANZ, P2EVENG2, and P2EVENG, had negative factor loadings on factor 1; P2PARGRP, P2EVENG2, and P2EVENG had negative factor loadings on factor2; P2ATTENP, P2CLUB, and P2ORGANZ had negative factor loadings on factor 3.

Item 19 was delimited due to crossloadings on more than one factor.

* Item 2, 3, 10, and 23 were delimited due to a factor loading less than 0.3.

Each chi-square difference test indicated a statistically significant improvement in the model fit with each additional factor included for the four waves. The fit statistics (RMSEA and CFI) taken together indicated that the three-factor model appears to provide the best fit to the data across four waves. All the values of RMSEA were less than 0.05, and the values of CFI were greater than 0.9 for the three-factor model across the four data analysis waves. It was concluded that the three-factor model provided a close fit to the data and was deemed the most appropriate model (Figure 1). Tables 13 presents the weighted sample size and fit statistics for one-, two- and three-factor solution at each time point.

Table 13

Fit Indices for One-, Two-, and Three-factor Solutions at Four Waves

	Observations	**Weighted sample size**	$\chi^2_{(df)}$	**CFI**	**RMSEA**
One-factor					
Kindergarten	14,765	3,368,322	$1901.484_{(52)}$	.679	.049
First	15,311	3,846,605	$2008.394_{(44)}$	.624	.054
Third	11,341*	3,313,202	$2579.751_{(48)}$	.532	.068
Fifth	10,018*	3,560,042	$1025.99_{(44)}$	.587	.047
Two-factor					
Kindergarten	14,765	3,368,322	$1769.01_{(49)}$	.745	.049
First	15,311	3,846,605	$1117.77_{(37)}$	.811	.044
Third	11,341*	3,313,202	$940.288_{(45)}$	.860	.042
Fifth	10,018*	3,560,042	$476.535_{(40)}$	.829	.033
Three-factor					
Kindergarten	14,765	3,368,322	$645.415_{(47)}$	.906	.031
First	15,311	3,846,605	$472.914_{(33)}$	.925	.030
Third	11,341*	3,313,202	$543.736_{(44)}$	.923	.032
Fifth	10,018*	3,560,042	$274.36_{(38)}$	.913	.025

Note. The observations at third- and fifth-grade waves were less than the numbers of the completed group reported in Chapter 2 because the information of weights, strata, and cluster was not available for some participants. They were eliminated from the CFA analysis.

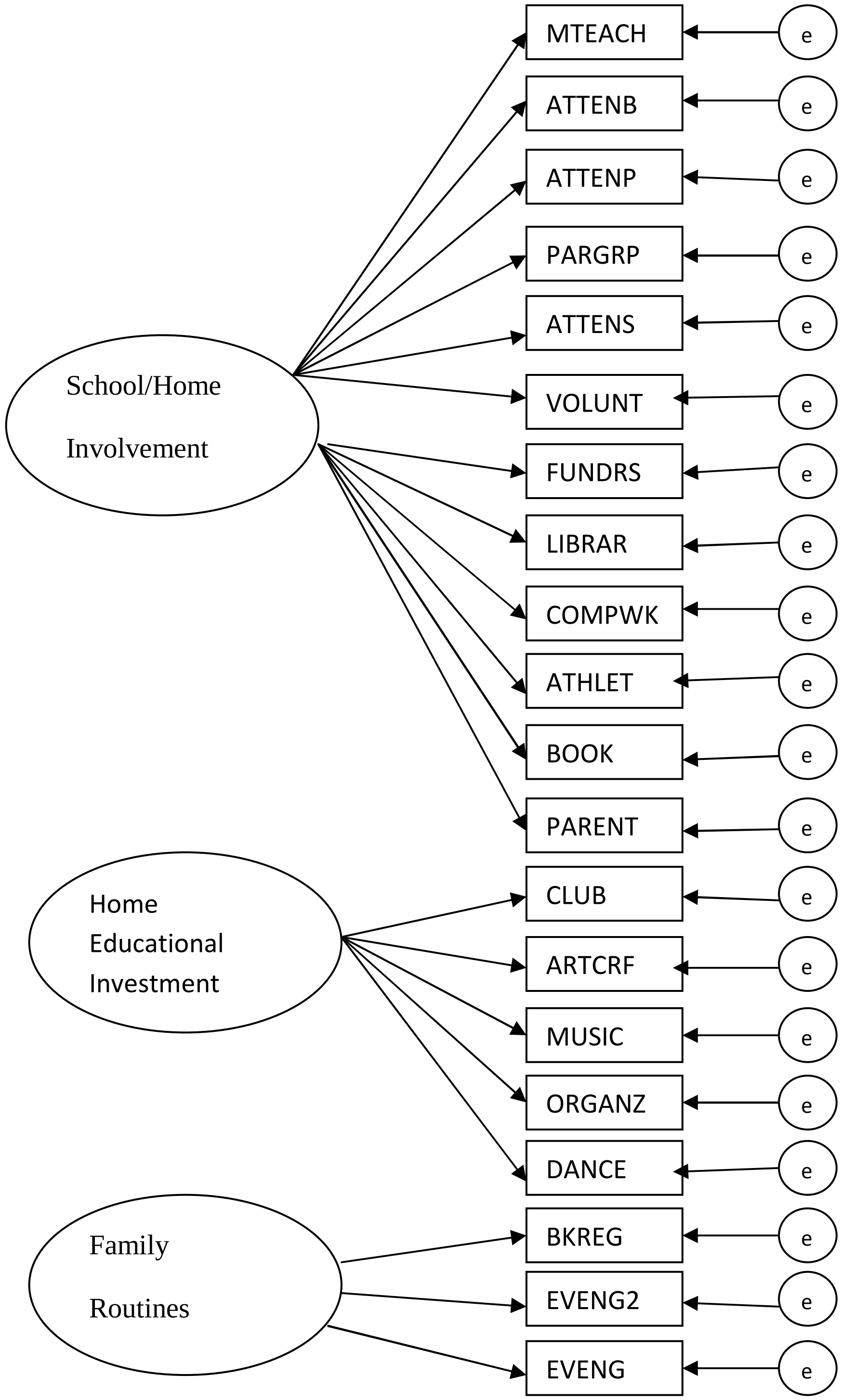

Figure 1. The Three-factor Model.

Factor Invariance Analyses. The three-factor model was chosen to test for factor structure invariance because it fit the data best. Fit indices indicated that all invariance models demonstrated an appropriate model fit with CFI around 0.9 and RMSEA less than 0.05. The values of CFI difference tests for comparisons between the configural invariance model and the metric invariance model, between the metric invariance model and the scalar model, and between the scalar model and the residual variance model were less than 0.01, indicating factor invariance was established (Hu & Bentler, 1998). It was concluded that the longitudinal factor structure exists across four waves. Table 14 provides tests of the various invariance models.

Table 14

Fit Indices for Invariance Models

Model	CFI	RMSEA	Δ CFI
1. Configural	.898	.033	
2. Metric	.898	.033	
Difference between Model 2 & Model 1			.000
3. Scalar	.898	.033	
Difference between Model 2 & Model 3			.000
4. Residual variances	.897	.034	
Difference between Model 3 & Model 4			.001

Part IV: IRT approaches

Multidimensional Item Response Theory. The MIRT procedures consisted of assessing model fits for three models (one-, two-, and three-factor solutions) defined by EFA across the kindergarten-, first-, third-, and fifth-grade waves. The ConQuest computer program was used to evaluate model fit (Wu, Adams, Wilson, & Haldane, 2007). The goodness of model fit for three solutions was compared using AIC, AIC_{pc}, BIC, BIC_{pc}, and RMSEA. The results of MIRT at four waves are shown in Table 15 to 18.

Table 15

Fits Indices for Three Models at Kindergarten Wave

	One-factor	Two-factor	Three-factor
Deviance	495252.03	419758.17	389632.8
sample size	13101	13101	13101
parameters	37	34	35
df	13064	13067	13066
AIC	521454.03	445960.17	415834.8
X^2_{AIC}	75493.86	30125.39	
p value for X^2_{AIC}	<0.001	<0.001	
AICPC	39.92	34.13	31.83
BIC	495404.37	419898.16	389776.9
X^2_{BIC}	75506.21	30121.27	
p value for X^2_{BIC}	<0.001	<0.001	
BICpc	37.92	32.13	29.83
RMSEA	0.053	0.049	0.047

Table 16

Fits Indices for Three Models at First-grade Wave

	One-factor	Two-factor	Three-factor
Deviance	511695.58	433514.76	406063.71
sample size	15311.00	15311.00	15311.00
parameters	37.00	34.00	35.00
Df	15274.00	15277.00	15276.00
AIC	542317.58	464136.76	436685.71
X^2_{AIC}	78180.82	27451.05	
p value for X^2_{AIC}	<0.001	<0.001	
AICPC	35.51	30.38	28.59
BIC	511850.43	433657.05	406210.19
X^2_{BIC}	78193.38	27446.86	
p value for X^2_{BIC}	<0.001	<0.001	
BICpc	33.51	28.39	26.59
RMSEA	0.05	0.042	0.041

Table 17

Fits Indices for Three Models at Third-grade Wave

	One-factor	Two-factor	Three-factor
Deviance	*385144.77*	*325984.15*	*306715.75*
sample size	*11341.00*	*11341.00*	*11341.00*
parameters	*37.00*	*34.00*	*35.00*
Df	*11304.00*	*11307.00*	*11306.00*
AIC	*407826.77*	*348666.15*	*329397.75*
X^2_{AIC}	*59160.62*	*19268.40*	
p value for X^2_{AIC}	*<0.001*	*<0.001*	
AICPC	*36.08*	*30.84*	*29.13*
BIC	*385294.79*	*326122.01*	*306857.66*
X^2_{BIC}	*59172.78*	*19264.35*	
p value for X^2_{BIC}	*<0.001*	*<0.001*	
BICpc	*34.08*	*28.84*	*27.14*
RMSEA	*0.05*	*0.049*	*0.048*

Table 18

Fits Indices for Three Models at Fifth-grade Wave

	One-factor	Two-factor	Three-factor
Deviance	*370707.32*	*316165.51*	*298966.75*
sample size	*10788.00*	*10788.00*	*10788.00*
parameters	*37.00*	*34.00*	*35.00*
Df	*10751.00*	*10754.00*	*10753.00*
AIC	*392283.32*	*337741.51*	*320542.75*
X^2_{AIC}	*54541.81*	*17198.76*	
p value for X^2_{AIC}	*<0.001*	*<0.001*	
AICPC	*36.49*	*31.41*	*29.81*
BIC	*370856.54*	*316302.63*	*299107.90*
X^2_{BIC}	*54553.91*	*17194.73*	
p value for X^2_{BIC}	*<0.001*	*<0.001*	
BICpc	*34.50*	*29.41*	*27.82*
RMSEA	*0.06*	*0.051*	*0.050*

Using the AIC and BIC values, two chi-square difference tests were conducted. First, the researcher compared the values of the AIC and the BIC for the one-factor model and the two-factor model at four time points. The results indicated that the values of chi-square were significantly different ($p<0.001$), and the two-factor model, with smaller values of AIC and BIC, was a better-fit model across four waves. Then, the researcher compared the values of the two-factor model to the three-factor model. All the difference values were statistically significant ($p<0.001$), and the AIC and BIC values of the three-factor model were smaller. The fit statistics from two phases taken together suggested that the better fitting model was the 3-factor model across four time points (Tables 15 to 18).

The values of the AICpc and the BICpc revealed the same findings, the three-factor model fit the data best. The AICpc and the BICpc values generated from the three-factor solution at four waves were the smallest among the one-, two-, and three-factor models. Also, the values of RMSEA generated from the three-factor model across four waves were less than 0.05. Overall, the fit statistics indicated that the three-factor model fit the data better than the other two models, and the three-factor model was deemed the correct model, as determined by the MIRT analyses.

The MIRT and CFA approaches yielded the same result and suggested a three-factor model fits the data best. Therefore, conclusive results were found with respect to the factor structure of parent involvement for these 20 items. The remaining analyses focused on a three-factor model where the three factors were named school/home involvement, home educational investment, and family routines, respectively.

Item fit for these items of the three-factor model was assessed at four waves through weighted (infit) MNSQ and t statistics in MIRT. Using both significant item misfit based on the t statistics (the absolute value of t greater than 1.97) and the weighted MNSQ (out of the range between 0.75 and 1.33), the MIRT resulted in no items demonstrating significant misfit across four time points (t<-1.97 or t> 1.97 and MNSQ<0.75 or MNSQ>1.33) (Tables 19-22).

Table 19

Multidimensional Item Response Theory at Kindergarten Wave: The Three-factor Model Parameter Estimates

TABLES OF RESPONSE MODEL PARAMETER ESTIMATES

TERM 1: item

VARIABLES				UNWEIGHTED FIT			WEIGHTED FIT		
ID	item	ESTIMATE	ERROR^	MNSQ	CI	T	MNSQ	CI	T
1	p1mteach	-3.425	0.011	0.82	(0.98, 1.02)	-16.9	1.03	(0.86, 1.14)	0.4
4	p2attenb	-0.630	0.010	0.90	(0.98, 1.02)	-8.6	0.92	(0.97, 1.03)	-6.1
5	p2attenp	1.292	0.010	1.06	(0.98, 1.02)	5.4	1.05	(0.98, 1.02)	3.9
6	p2pargrp	-1.452	0.010	1.01	(0.98, 1.02)	0.9	1.04	(0.96, 1.04)	1.8
7	p2attens	-0.240	0.010	0.92	(0.98, 1.02)	-7.2	0.96	(0.98, 1.02)	-4.0
8	P2VOLUNT	0.651	0.010	0.86	(0.98, 1.02)	-12.7	0.90	(0.98, 1.02)	-11.9
9	P2FUNDRS	0.104	0.010	0.96	(0.98, 1.02)	-3.3	0.98	(0.98, 1.02)	-2.1
11	P2LIBRAR	0.372	0.010	1.05	(0.98, 1.02)	4.2	1.04	(0.98, 1.02)	4.1
12	P2COMPWK	1.358	0.008	1.21	(0.98, 1.02)	16.6	1.16	(0.97, 1.03)	9.1
13	P2DANCE	-0.539	0.018	0.92	(0.98, 1.02)	-6.8	0.93	(0.96, 1.04)	-3.2
14	P2ATHLET	0.740	0.010	0.92	(0.98, 1.02)	-7.4	0.93	(0.98, 1.02)	-7.5
15	p2club	-0.246	0.019	1.05	(0.98, 1.02)	4.1	1.05	(0.95, 1.05)	2.0
16	P2MUSIC	0.543	0.021	1.04	(0.98, 1.02)	3.5	0.94	(0.93, 1.07)	-1.7
17	P2ARTCRF	0.567	0.021	1.09	(0.98, 1.02)	7.4	1.00	(0.93, 1.07)	0.1
18	P2ORGANZ	-0.325*	0.039	0.92	(0.98, 1.02)	-6.7	1.01	(0.95, 1.05)	0.5
20	P2BKREG	-0.147	0.009	1.15	(0.98, 1.02)	12.7	1.15	(0.97, 1.03)	8.8
21	P2EVENG2	-0.039	0.009	1.04	(0.98, 1.02)	3.5	1.00	(0.97, 1.03)	0.2
22	P2EVENG	0.186*	0.013	0.89	(0.98, 1.02)	-9.5	0.92	(0.97, 1.03)	-5.3
24	BOOK5	0.596	0.007	1.09	(0.98, 1.02)	7.5	1.09	(0.97, 1.03)	5.7
25	PARENT	0.634*	0.032	1.08	(0.98, 1.02)	6.8	1.06	(0.97, 1.03)	4.0

An asterisk next to a parameter estimate indicates that it is constrained

Table 20

Multidimensional Item Response Theory at First Wave: The Three-factor Model Parameter Estimates

TABLES OF RESPONSE MODEL PARAMETER ESTIMATES

TERM 1: item

VARIABLES				UNWEIGHTED FIT			WEIGHTED FIT		
ID	item	ESTIMATE	ERROR^	MNSQ	CI	T	MNSQ	CI	T
4	P4ATTENB	-0.674	0.007	0.87	(0.98, 1.02)	-11.8	0.92	(0.96, 1.04)	-4.3
5	P4ATTENP	1.175	0.007	1.06	(0.98, 1.02)	5.3	1.04	(0.98, 1.02)	3.4
6	P4PARGRP	-1.470	0.007	1.01	(0.98, 1.02)	1.3	1.00	(0.94, 1.06)	-0.1
7	P4ATTENS	-0.361	0.007	0.88	(0.98, 1.02)	-11.0	0.96	(0.97, 1.03)	-2.7
8	P4VOLUNT	0.847	0.007	0.84	(0.98, 1.02)	-14.8	0.86	(0.98, 1.02)	-13.2
9	P4FUNDRS	0.049	0.007	0.94	(0.98, 1.02)	-5.7	0.98	(0.97, 1.03)	-1.5
1	P4MTEACH	-4.073	0.008	0.78	(0.98, 1.02)	-21.0	1.08	(0.73, 1.27)	0.6
11	P4LIBRAR	0.977	0.007	1.07	(0.98, 1.02)	5.6	1.06	(0.98, 1.02)	5.6
12	P4COMPWK	1.486	0.006	1.19	(0.98, 1.02)	15.7	1.18	(0.96, 1.04)	8.9
13	P4DANCE	-0.190	0.016	0.95	(0.98, 1.02)	-4.5	0.96	(0.95, 1.05)	-1.6
14	P4ATHLET	0.556	0.007	0.91	(0.98, 1.02)	-7.9	0.93	(0.98, 1.02)	-6.8
15	p4club	-0.853	0.015	1.05	(0.98, 1.02)	4.4	1.03	(0.96, 1.04)	1.6
16	P4MUSIC	0.667	0.018	1.02	(0.98, 1.02)	1.5	0.94	(0.93, 1.07)	-1.7
17	P4ARTCRF	0.620	0.018	1.00	(0.98, 1.02)	-0.2	1.04	(0.93, 1.07)	1.1
18	P4ORGANZ	-0.244*	0.034	0.93	(0.98, 1.02)	-5.8	1.02	(0.95, 1.05)	0.7
20	P4BKREG	-0.137	0.009	1.15	(0.98, 1.02)	12.6	1.18	(0.96, 1.04)	8.8
21	P4EVENG2	-0.093	0.009	1.01	(0.98, 1.02)	0.5	0.99	(0.96, 1.04)	-0.3
22	P4EVENG	0.230*	0.013	0.89	(0.98, 1.02)	-9.7	0.93	(0.96, 1.04)	-3.5
25	parent	0.737	0.006	1.04	(0.98, 1.02)	3.3	1.05	(0.97, 1.03)	3.0
24	book5	0.752*	0.023	1.14	(0.98, 1.02)	11.3	1.13	(0.96, 1.04)	6.5

An asterisk next to a parameter estimate indicates that it is constrained

Table 21

Multidimensional Item Response Theory at Third Wave: The Three-factor Model Parameter Estimates

TABLES OF RESPONSE MODEL PARAMETER ESTIMATES

TERM 1: item

VARIABLES				UNWEIGHTED FIT			WEIGHTED FIT		
ID	item	ESTIMATE	ERROR^	MNSQ	CI	T	MNSQ	CI	T
4	P5ATTENB	-0.853	0.012	0.78	(0.97, 1.03)	-17.7	0.97	(0.93, 1.07)	-0.7
5	P5ATTENP	1.157	0.011	1.05	(0.97, 1.03)	3.6	1.01	(0.96, 1.04)	0.5
6	P5PARGRP	-1.670	0.013	1.03	(0.97, 1.03)	2.1	0.94	(0.87, 1.13)	-0.9
7	P5ATTENS	-0.572	0.012	0.84	(0.97, 1.03)	-12.7	0.96	(0.94, 1.06)	-1.3
8	P5VOLUNT	1.016	0.011	0.87	(0.97, 1.03)	-10.2	0.89	(0.96, 1.04)	-5.6
9	P5FUNDRS	0.092	0.012	0.90	(0.97, 1.03)	-8.0	0.95	(0.96, 1.04)	-2.3
1	P5MTEACH	-3.796	0.014	0.70	(0.97, 1.03)	-25.4	1.04	(0.54, 1.46)	0.3
11	P5DANCE	0.527	0.019	1.03	(0.97, 1.03)	2.0	0.99	(0.89, 1.11)	-0.1
12	P5ATHLET	0.529	0.011	0.96	(0.97, 1.03)	-3.2	1.00	(0.96, 1.04)	-0.1
13	p5club	-0.855	0.017	1.04	(0.97, 1.03)	3.2	1.03	(0.94, 1.06)	0.9
14	P5MUSIC	0.069	0.018	1.03	(0.97, 1.03)	1.9	0.99	(0.91, 1.09)	-0.2
15	P5ARTCRF	0.603	0.019	1.00	(0.97, 1.03)	-0.2	1.10	(0.88, 1.12)	1.7
16	P5ORGANZ	-0.343*	0.037	0.93	(0.97, 1.03)	-5.1	1.06	(0.92, 1.08)	1.4
17	P5LIBRAR	0.661	0.011	1.08	(0.97, 1.03)	5.6	1.06	(0.96, 1.04)	3.1
18	P5COMPWK	1.202	0.009	1.17	(0.97, 1.03)	12.1	1.23	(0.94, 1.06)	6.7
20	P5BKREG	-0.067	0.011	1.17	(0.97, 1.03)	12.4	1.22	(0.93, 1.07)	6.1
21	P5EVENG2	-0.188	0.010	0.94	(0.97, 1.03)	-4.3	0.96	(0.93, 1.07)	-1.0
22	P5EVENG	0.256*	0.015	0.87	(0.97, 1.03)	-10.1	0.93	(0.93, 1.07)	-2.2
24	book5	1.193	0.008	1.12	(0.97, 1.03)	8.6	1.13	(0.94, 1.06)	3.8
25	parent	1.039*	0.038	0.99	(0.97, 1.03)	-0.7	0.95	(0.94, 1.06)	-1.6

An asterisk next to a parameter estimate indicates that it is constrained

Table 22

Multidimensional Item Response Theory at Fifth Wave: The Three-factor Model Parameter Estimates

TABLES OF RESPONSE MODEL PARAMETER ESTIMATES

TERM 1: item

VARIABLES				UNWEIGHTED FIT			WEIGHTED FIT		
ID	item	ESTIMATE	ERROR^	MNSQ	CI	T	MNSQ	CI	T
4	P6ATTENB	-0.736	0.012	0.78	(0.97, 1.03)	-17.9	0.99	(0.90, 1.10)	-0.1
5	P6ATTENP	1.222	0.011	1.04	(0.97, 1.03)	2.7	0.96	(0.95, 1.05)	-1.4
6	P6PARGRP	-1.443	0.012	0.97	(0.97, 1.03)	-2.0	0.97	(0.84, 1.16)	-0.3
7	P6ATTENS	-0.467	0.011	0.84	(0.97, 1.03)	-12.8	0.94	(0.92, 1.08)	-1.5
8	P6VOLUNT	1.128	0.011	0.88	(0.97, 1.03)	-9.2	0.88	(0.95, 1.05)	-4.9
9	P6FUNDRS	-0.113	0.011	0.92	(0.97, 1.03)	-6.4	0.94	(0.94, 1.06)	-1.8
1	P6MTEACH	-3.306	0.013	0.55	(0.97, 1.03)	-39.3	1.15	(0.55, 1.45)	0.7
11	P6DANCE	0.649	0.020	1.09	(0.97, 1.03)	6.8	0.91	(0.84, 1.16)	-1.1
12	P6ATHLET	0.254	0.011	0.95	(0.97, 1.03)	-3.5	0.99	(0.95, 1.05)	-0.2
13	p6club	-0.501	0.017	1.10	(0.97, 1.03)	7.1	0.97	(0.91, 1.09)	-0.6
14	P6MUSIC	-0.585	0.017	1.00	(0.97, 1.03)	-0.3	0.98	(0.91, 1.09)	-0.5
15	P6ARTCRF	0.775	0.020	1.04	(0.97, 1.03)	2.6	1.04	(0.83, 1.17)	0.5
16	P6ORGANZ	-0.338*	0.037	0.91	(0.97, 1.03)	-7.1	0.97	(0.90, 1.10)	-0.6
17	P6LIBRAR	0.787	0.011	1.08	(0.97, 1.03)	5.4	1.09	(0.96, 1.04)	3.9
18	P6COMPWK	0.766	0.008	1.13	(0.97, 1.03)	9.1	1.19	(0.92, 1.08)	4.3
20	P6BKREG	-0.133	0.011	1.11	(0.97, 1.03)	7.7	1.10	(0.91, 1.09)	2.2
21	P6EVENG2	-0.132	0.010	0.96	(0.97, 1.03)	-3.1	0.96	(0.91, 1.09)	-0.9
22	P6EVENG	0.265*	0.015	0.90	(0.97, 1.03)	-7.5	0.97	(0.92, 1.08)	-0.6
24	book5	0.812	0.007	1.18	(0.97, 1.03)	12.4	1.14	(0.91, 1.09)	3.0
25	parent	1.095*	0.036	1.00	(0.97, 1.03)	0.3	0.95	(0.92, 1.08)	-1.4

An asterisk next to a parameter estimate indicates that it is constrained

Unidimensionality. Before a series of IRT approaches were conducted in order to evaluate items within each domain, the assumption of unidimensionality of IRT at kindergarten-, first-, third- and fifth-wave was checked for three dimensions, respectively, using Winsteps. Approximate unidimensionality was assessed by examining the percents of raw variance explained by measures, and the value and the percents of unexplained variance in the 1st contrast as well as the values of weighted (INFIT) and unweighted (OUTFIT) MNSQs. In order to establish the assumption of unidimensionality, the expected percent of variance explained by measures for empirical data should be greater than 60%, the expected value of unexplained variance in the 1st contrast should be less than 3, and the expected percent of unexplained variance in the 1st contrast should be less than 5%. The results indicated that at four waves, the percent of variance explained by measures in school/home involvement domain ranged between 41.4% and 46.3%, less than 60 %. The percents of variances explained by measures for empirical data did not meet the criteria. However, the values of unexplained variance in 1st contrast were about 1.6, and the percents of unexplained variance in 1st contrast were between 6.7% and 8% (Table 21). The values of MNSQs of INFIT and OUTFIT ranged from 0.96 to 1.03, very close to 1. Overall, the data of the domain of school/home involvement met the assumption of unidimensionality though not perfectly. Table 23 provides the results of unidimensionality test of the school/home involvement.

Table 23

Test of the Assumption of Unidimensionality of the Domain of School/home Involvement

	Kindergarten	**First**	**Third**	**Fifth**
Raw variance explained by measures	46.30%	45.70%	43.30%	41.40%
Unexplained variance in the 1st contrast	1.50	1.60	1.60	1.60
Unexplained variance in 1st contrast	6.70%	7.10%	7.60%	8.00%
INFIT MNSQ	1.01	1.02	1.03	1.03
OUTFIT MNSQ	1.00	.97	.96	.96

For the home educational investment domain, the percents of raw variance explained by measures ranged from 19.9% to 22%, which were far away from the minimum percentage (60%). The percents of unexplained variance in the 1st contrast were between 22.8% and 29.6 %, which were greater than 6%. However, the MNSQ of INFIT and OUTFIT met the criteria (close to 1) and the values of unexplained variance in the 1st contrast were less than 3. (Table 24 provides the test for the home educational investment domain). The assumption of unidimensionality was considered as tenable but the researcher still needed to be cautious when interpreting the results of following data analyses.

Table 24

Tests of the Assumption of Unidimensionality of the Domain of Home Educational Investment

	Kindergarten	First	Third	Fifth
Raw variance explained by measures	19.90%	21.70%	21.60%	22.00 %
Unexplained variance in the 1st contrast	1.50	1.50	1.50	1.50
Unexplained variance in 1st contrast	29.60%	23.20%	23.20%	22.80 %
INFIT MNSQ	1.00	.99	.99	1.00
OUTFIT MNSQ	1.01	1.01	1.00	1.00

Regarding tests of the unidimensionality assumption for the domain of family routines, the results were very similar to the findings in the home educational investment domain. The percents of raw variance explained by measures ranged between 34.7% and 42.9%, which were far away from the ideal percentage (60%). The percents of unexplained variance in 1st contrast were between 32.3% and 32.9 %, which were greater than 6%. The MNSQ of INFIT and OUTFIT were between 0.92 and 0.96, and the values of unexplained variance in 1st contrast were between 1.7 and 1.8, less than 3. Thus, the assumption of unidimensionality for the domain of family routines was considered to be adequately met. Table 25 shows the examination for the family routines domain.

Table 25

Tests of Unidimensionality Assumption of the Domain of Family Routines

	Kindergarten	First	Third	Fifth
Raw variance explained by measures	34.70%	38.70%	42.70%	42.90%
Unexplained variance in the 1st contrast	1.70	1.70	1.80	1.70
Unexplained variance in 1st contrast	36.60%	34.70%	34.30%	32.30%
INFIT MNSQ	.95	.92	.90	.92
OUTFIT MNSQ	.97	.96	.95	.96

Item Ordering. Examining the order of items along the continuum is one of the practices recommended to establish the validity of measures (Fox & Jones, 1998). An adequate measure should have items which spread out in order to cover people's ability/agreement from low to high. According to Figures 2 to 5, the reported frequencies of the domain of school/home involvement and of family routines were negatively skewed whereas the distribution of reported frequencies of the domain of home educational investment was positively skewed. These results indicated that parents sampled for this study appeared to be more involved in school/home involvement and family routines, but provide less home educational investment to their children. Additionally, Figures 2 to 5 suggested that items capture parents who reported an average frequency of three factors. These 20 items were not widely dispersed and they failed to capture responses either from parents who were highly involved in school/home involvement or family routines or from parents providing less home educational investment for their children.

MAP OF LATENT DISTRIBUTIONS AND RESPONSE MODEL PARAMETER ESTIMATES

```
================================================================================
             Dimension
------------------------------
     Dimension1  Dimension 2 Dimension 3              +item
------------------------------------------------------------------------
                |         |         |                                  |
                |         |         |                                  |
   4            |         |         |                                  |
                |         |         |                                  |
                |         |         |                                  |
                |         |         |                                  |
                |         |        X|                                  |
   3            |         |        X|                                  |
                |         |        X|                                  |
                |         |       XX|                                  |
               X|         |       XX|                                  |
   2          XX|         |      XXX|                                  |
             XXX|         |      XXX|                                  |
            XXXX|         |   XXXXXX|                                  |
          XXXXXX|         |    XXXXX|p2compwk                          |
          XXXXXX|         |  XXXXXXX|p2attenp                          |
   1  XXXXXXXXXX|         |  XXXXXXX|                                  |
        XXXXXXXX|         | XXXXXXXX|p2athlet                          |
        XXXXXXXX|         | XXXXXXXX|p2volunt p2music p2artcrf book5 parent|
      XXXXXXXXXX|        X|XXXXXXXXX|p2librar                          |
       XXXXXXXXX|        X|  XXXXXXX|p2fundrs p2eveng                  |
   0     XXXXXXX|        X|   XXXXXX|p2eveng2                          |
          XXXXXX|       XX|    XXXXX|p2attens p2club p2organz p2bkreg  |
            XXXX|        X|     XXXX|p2dance                           |
            XXXX|       XX|      XXX|p2attenb                          |
             XXX|       XX|      XXX|                                  |
  -1           X|      XXX|        X|                                  |
               X|      XXX|        X|                                  |
               X|    XXXXX|        X|p2pargrp                          |
                |    XXXXX|         |                                  |
  -2            |     XXXX|         |                                  |
                |  XXXXXXX|         |                                  |
                |   XXXXXX|         |                                  |
                |   XXXXXX|         |                                  |
                |   XXXXXX|         |                                  |
  -3            |    XXXXX|         |                                  |
                |    XXXXX|         |                                  |
                |   XXXXXX|         |p1mteach                          |
                |     XXXX|         |                                  |
                |      XXX|         |                                  |
  -4            |      XXX|         |                                  |
                |       XX|         |                                  |
                |      XXX|         |                                  |
                |       XX|         |                                  |
  -5            |        X|         |                                  |
                |        X|         |                                  |
                |        X|         |                                  |
                |         |         |                                  |
                |        X|         |                                  |
  -6            |         |         |                                  |
 ========================================================================
```

Each 'X' represents 155.6 cases. Numbers, -6 to 4, represent participants' logit positions. A higher number of logit position demonstrates a higher level of parent involvement whereas a lower number of logit position presents a lower level of parent involvement.

Figure 2. The Three-factor Model Item Difficulty Plot at Kindergarten Wave

MAP OF LATENT DISTRIBUTIONS AND RESPONSE MODEL PARAMETER ESTIMATES

```
================================================================================
             Dimension
------------------------------
     Dimension Dimension Dimension 3              +item
------------------------------------------------------------------------
                |         |         |                                   |
                |         |         |                                   |
   4            |         |         |                                   |
                |         |         |                                   |
                |         |         |                                   |
                |         |         |                                   |
                |         |        X|                                   |
   3            |         |        X|                                   |
               X|         |        X|                                   |
               X|         |        X|                                   |
               X|         |       XX|                                   |
             XXX|         |       XX|                                   |
   2         XXX|         |      XXX|                                   |
           XXXXX|         |      XXX|                                   |
         XXXXXXX|         |    XXXXX|                                   |
         XXXXXXX|         |   XXXXXX|p4compwrk                          |
      XXXXXXXXXX|         |    XXXXX|                                   |
   1   XXXXXXXXX|         |  XXXXXXX|p4attenp                           |
       XXXXXXXXX|        X| XXXXXXXX|p4volunt p4librar                  |
      XXXXXXXXXX|        X| XXXXXXXX|p4music p4artcrf parent book5     |
      XXXXXXXXXX|        X| XXXXXXXX|p4athlet                           |
         XXXXXXX|        X| XXXXXXXX|p4eveng                            |
   0      XXXXXX|       XX| XXXXXXXX|p4fundrs                           |
           XXXXX|       XX|   XXXXXX|p4dance p4bkreg p4eveng2           |
            XXXX|       XX|    XXXXX|p4attens p4organz                  |
              XX|      XXX|     XXXX|                                   |
              XX|     XXXX|      XXX|p4attenb                           |
  -1           X|    XXXXX|      XXX|p4club                             |
               X|   XXXXXX|       XX|                                   |
                |    XXXXX|        X|                                   |
                |   XXXXXX|        X|p4pargrp                           |
                | XXXXXXXX|         |                                   |
  -2            |   XXXXXX|        X|                                   |
                |  XXXXXXX|         |                                   |
                |   XXXXXX|         |                                   |
                |    XXXXX|         |                                   |
                |   XXXXXX|         |                                   |
  -3            |    XXXXX|         |                                   |
                |     XXXX|         |                                   |
                |     XXXX|         |                                   |
                |      XXX|         |                                   |
                |      XXX|         |                                   |
  -4            |       XX|         |                                   |
                |       XX|         |p4mteach                           |
                |        X|         |                                   |
                |        X|         |                                   |
                |         |         |                                   |
  -5            |        X|         |                                   |
                |         |         |                                   |
                |         |         |                                   |
========================================================================
```

Each 'X' represents 148.1 cases

Values represent participants' logit positions and these numbers mean the levels of parent involvement at the first grade range between -5 and 4.

Figure 3. The Three-factor Model Item Difficulty Plot at First Wave

MAP OF LATENT DISTRIBUTIONS AND RESPONSE MODEL PARAMETER ESTIMATES

```
=================================================================================
             Dimension
------------------------------
     Dimension Dimension Dimension 3              +item
-------------------------------------------------------------------------
  5              |         |         |                                  |
                 |         |         |                                  |
                 |         |         |                                  |
                 |         |         |                                  |
                 |         |         |                                  |
  4              |         |         |                                  |
                 |         |         |                                  |
                 |         |         |                                  |
                 |         |         |                                  |
                 |         |        X|                                  |
  3              |         |        X|                                  |
                 |         |        X|                                  |
                X|         |       XX|                                  |
               XX|         |       XX|                                  |
              XXX|         |       XX|                                  |
  2          XXXX|         |      XXX|                                  |
           XXXXXX|         |      XXX|                                  |
          XXXXXXX|         |     XXXX|                                  |
        XXXXXXXXX|         |     XXXX|                                  |
       XXXXXXXXXX|         |    XXXXX|p5attenp p5compwk book5           |
  1    XXXXXXXXXX|        X|  XXXXXXX|p5volunt parent                  |
        XXXXXXXXX|        X|   XXXXXX|                                  |
         XXXXXXXX|        X|   XXXXXX|p5dance p5athlet p5librar p5compwk|
          XXXXXXX|        X|   XXXXXX|                                  |
           XXXXXX|       XX|   XXXXXX|p5fundrs p5eveng                  |
  0         XXXXX|       XX|    XXXXX|p5music p5bkreg                   |
              XXX|      XXX|   XXXXXX|p5eveng2                          |
               XX|      XXX|    XXXXX|p5organz                          |
               XX|     XXXX|     XXXX|p5attens                          |
                X|     XXXX|      XXX|p5attenb p5club                   |
 -1              |   XXXXXX|      XXX|                                  |
                 |   XXXXXX|       XX|                                  |
                 |    XXXXX|       XX|                                  |
                 |  XXXXXXX|        X|p5pargrp                          |
                 |  XXXXXXX|        X|                                  |
 -2              |  XXXXXXX|        X|                                  |
                 |   XXXXXX|        X|                                  |
                 |   XXXXXX|         |                                  |
                 |     XXXX|         |                                  |
                 |    XXXXX|         |                                  |
 -3              |     XXXX|         |                                  |
                 |      XXX|         |                                  |
                 |       XX|         |                                  |
                 |       XX|         |                                  |
                 |        X|         |p5mteach                          |
 -4              |        X|         |                                  |
                 |        X|         |                                  |
                 |        X|         |                                  |
                 |         |         |                                  |
                 |         |         |                                  |
=========================================================================
```

Each 'X' represents 117.1 cases

Values represent participants' logit positions and these numbers mean the levels of parent involvement at the third grade range between -4 and 3

Figure 4. The Three-factor Model Item Difficulty Plot at Third Wave

MAP OF LATENT DISTRIBUTIONS AND RESPONSE MODEL PARAMETER ESTIMATES

```
================================================================================
             Dimension
------------------------------
     Dimension Dimension Dimension 3              +item
------------------------------------------------------------------------
                 |          |          |                                    |
    4            |          |          |                                    |
                 |          |          |                                    |
                 |          |          |                                    |
                 |          |          |                                    |
                 |          |          |                                    |
    3            |          |          |                                    |
                 |          |         X|                                    |
                 |          |         X|                                    |
                X|          |         X|                                    |
                X|          |        XX|                                    |
               XX|          |         X|                                    |
    2         XXX|          |        XX|                                    |
            XXXXX|          |        XX|                                    |
           XXXXXX|          |        XX|                                    |
           XXXXXX|          |       XXX|                                    |
       XXXXXXXXXX|          |      XXXX|p6attenp p6volunt                   |
    1   XXXXXXXXX|         X|     XXXXX|parent                              |
       XXXXXXXXXX|         X|    XXXXXX|p6artcrp p6librar p6compwk book5    |
         XXXXXXXX|         X|    XXXXXX|p6dance                             |
         XXXXXXXX|         X|    XXXXXX|                                    |
           XXXXXX|        XX|    XXXXXX|p6athlet p6eveng                    |
           XXXXXX|        XX|   XXXXXXX|                                    |
    0        XXXX|        XX|    XXXXXX|p6fundrs p6bkreg p6eveng2           |
              XXX|        XX|     XXXXX|p6organz                            |
               XX|       XXX|     XXXXX|p6attens p6club                     |
                X|      XXXX|      XXXX|p6music                             |
                X|      XXXX|      XXXX|p6attenb                            |
   -1            |    XXXXXX|       XXX|                                    |
                 |     XXXXX|       XXX|                                    |
                 |    XXXXXX|        XX|                                    |
                 |    XXXXXX|         X|p6pargrp                            |
                 |    XXXXXX|         X|                                    |
                 |    XXXXXX|         X|                                    |
   -2            |     XXXXX|          |                                    |
                 |     XXXXX|          |                                    |
                 |      XXXX|          |                                    |
                 |     XXXXX|          |                                    |
                 |       XXX|          |                                    |
   -3            |       XXX|          |                                    |
                 |       XXX|          |                                    |
                 |        XX|          |p6mteach                            |
                 |         X|          |                                    |
                 |         X|          |                                    |
                 |         X|          |                                    |
   -4            |         X|          |                                    |
                 |         X|          |                                    |
                 |          |          |                                    |
                 |          |          |                                    |
                 |          |          |                                    |
  ========================================================================
```

Each 'X' represents 117.6 cases

Values represent participants' logit positions and these numbers mean the levels of parent involvement at the fifth grade range between -4 and 3.

Figure 5. The Three-factor Model Item Difficulty Plot at Fifth Wave

Step Structure Analyses. Tests of category structure were performed in this study in order to examine the appropriateness of item calibration. The observed average and structure calibration increased in order from category 1 to the higher category for items of each domain at each wave. The step calibration statistics revealed that the structure of parent involvement in this study met the requirement and the measure defined a distinct position on the parent involvement continuum. Appendixes C through F provide the results of tests of category structure of items for the school/home involvement domain at four waves. Appendixes G through J show the findings from the domain of home investment from kindergarten to fifth grade. Appendixes K through M provide information of category structure for items in family routines domain at four time points.

Person and Item fit. The researcher examined item fit and person fit of the three-factor model through weighted MNSQs (INFIT) at four waves. As mentioned previously, the results of MNSQs suggested that the overall item fit and person fit were considered as satisfactory at every time point (0.75< observed MNSQ <1.33 suggested by Bond and Fox, 2001). The item fit statistics for items of the domains of school/home involvement and home educational investment revealed satisfactory fits. Table 26 and 27 provide the details of tests of item fit for these two domains.

The items statistics of the domain of family routines revealed a problematic item fit. The item fit of "How many days eat breakfast at a regular time?" ranged between 1.36 and 1.41 across four waves; the item fit of "How many days eat dinner together?" was below .75 at the third-wave; the item fit of "How many days eat dinner at a regular time?" was .74 and 0.69 at first-, and third-wave respectively. These findings suggested that questions regarding having dinner/breakfast at a regular time were misfitting items at four waves (Table 28). However, it was not appropriate to remove any item from this domain because this domain contained only three items. Thus, it was concluded that the observed data in the ECLS-K dataset provided items to assess the domains of school/home involvement and home educational investment, but they could not be used to assess the domain of family routines sufficiently.

Table 26

MNSQ Item Fit for the Domain of School/home Involvement

ID	Abbreviation	Kindergarten	First	Third	Fifth
1	MTEACH	1.04	0.97	1.03	0.92
4	ATTENB	0.91	0.89	0.90	0.88
5	ATTENP	1.07	1.09	1.07	1.03
6	PARGRP	1.07	1.06	1.06	1.03
7	ATTENS	0.95	0.93	0.89	0.91
8	VOLUNT	0.85	0.81	0.84	0.84
9	FUNDRS	0.99	0.99	0.93	0.93
11	LIBRAR	1.09	1.1	1.12	1.15
12	COMPWK	1.13	1.18	1.22	1.20
14	ATHLET	0.92	0.92	0.99	1.00
24	BOOK5	0.98	1.02	1.04	1.05
25	PARENT	1.07	1.05	0.94	0.96

Table 27

MNSQ Item Fit for the Domain of Home Educational investment

ID	Abbreviation	Kindergarten	First	Third	Fifth
15	CLUB	1.13	1.19	1.17	1.15
16	ARTCRF	1.05	1.03	1.04	1.04
17	MUSIC	0.98	0.98	0.94	0.99
18	ORGANZ	0.92	0.88	0.88	0.87
13	DANCE	0.92	0.91	0.94	0.94

Table 28

MNSQ Item Fit for the Domain of Family Routines

ID	Abbreviation	Kindergarten	First	Third	Fifth
20	BKREG	1.36	1.42	1.52	1.41
21	EVENG2	0.88	0.80	0.73	0.78
22	EVENG	0.75	0.74	0.69	0.77

Reliability. The reliability of three domains at four waves was examined through Cronbach's alpha, person reliability, and person separation. For the domain of school/home involvement, the person separation for non-extreme, and for extreme and non-extreme responses ranged from 1.31 to 1.53, and they indicated the replicability of person placement across other items measuring the same construct (Bond & Fox, 2001). The Cronbach's alpha coefficients were .68, .68, .64, and .61 at four waves respectively, slightly lower than an acceptable value of 0.7. The person reliability for non-extreme responses was similar to Cronbach's alpha coefficients at four waves. The person reliability for extreme and non-extreme responses showed slightly smaller values at the third- and fifth-grade wave (.66 and .65 respectively) while the values for kindergarten- and first-wave achieved .7. Therefore, these results supported a fair degree of replicability of person placement for assessing the school/home involvement across four time points.

Table 29

Person Reliability, Person Separation, and Cronbach's Alpha of the Domain of School/home Involvement

		Kindergarten	***First***	***Third***	***Fifth***
Person Reliability	*Non-extreme*	.69	.69	.65	.63
	Extreme and non-extreme	.70	.70	.66	.65
Person Separation	*Non-extreme*	1.50	1.48	1.35	1.31
	Extreme and non-extreme	1.53	1.52	1.40	1.36
Cronbach's alpha		.68	.68	.64	.61

The results of reliability of the other two domains indicated that there were neither enough items spread along the continuum nor enough spread of ability among persons. For the home educational investment domain, person reliability and person separation for both non-extreme responses and for the non-extreme and extreme responses were 0.0 because the adjusted measurement standard errors were 0.0 across four time points. In addition, the Cronbach's alpha coefficients ranged between 0.47 and 0.51, and these values were lower than an acceptable value of 0.7 (Table 30). The results of Table 31 indicated low reliability and poor person separation and person reliability. It was concluded the lack of replicability of person ordering on the home educational investment domain as well as on the domain of family routines.

Table 30

Person Reliability, Person Separation and Cronbach's Alpha of the Home Educational investment Domain

		Kindergarten	***First***	***Third***	***Fifth***
Person Reliability	*Non-extreme*	.00	. 00	.00	.00
	Extreme and non-extreme	.00	.00	.00	.00
Person Separation	*Non-extreme*	.00	.00	.00	.00
	Extreme and non-extreme	.00	.00	.00	.00
Cronbach's alpha		.49	.51	.47	.48

Table 31

Person Reliability, Person Separation and Cronbach's Alpha of the Family Routines Domain

		Kindergarten	***First***	***Third***	***Fifth***
Person Reliability	*Non-extreme*	0.00	0.00	0.14	0.16
	Extreme and non-extreme	0.32	0.38	0.46	0.46
Person Separation	*Non-extreme*	0.00	0.02	0.40	0.43
	Extreme and non-extreme	0.69	0.78	0.93	0.92
Cronbach's alpha		0.55	0.57	0.62	0.57

Differential Item Functioning (DIF). The researcher conducted DIF tests to determine whether or not parents with boys or girls responded to the measure of parent involvement differently. Due to the low reliability of the domains of home educational investment and family routines, DIF tests were performed only on the school/home involvement domain. According to Linacre (2007), the DIF contrast should be at least 0.5 logits for DIF to be noticeable *and* the p value of t-test is less than .05 for statistically significance DIF on an item. The results revealed that all items functioned properly, excluding the item "ATHLET" that functioned differentially at kindergarten wave (Table 32 and Figure 6). However, the item "ATHLET" did not have a problematic item fit in previous examination. Thus, removal of this item would not be recommended. In general, DIF tests suggested that the items for assessing school/home involvement were invariant across children's gender at four data analysis waves (Tables 33 to 35 and Figures 6 to 9).

Table 32

Differential Item Functioning (DIF) Summary Statistics at Kindergarten Wave

ID	**Abbreviation**	**DIF Contrast**	**t**	**p value**
1	MTEACH	0.00	0.00	1.00
4	ATTENB	0.00	0.00	1.00
5	ATTENP	0.08	31.13	<0.001
6	PARGRP	-0.19	-55.9	<0.001
7	ATTENS	0.09	34.82	<0.001
8	VOLUNT	0.09	35.62	<0.001
9	FUNDRS	0.00	0.00	1.00
11	LIBRAR	0.13	54.37	<0.001
12	COMPWK	-0.10	-69.6	<0.001
14	ATHLET	-0.73	-294	<0.001
24	BOOK5	0.08	70.9	<0.001
25	PARENT	-0.16	-101	<0.001

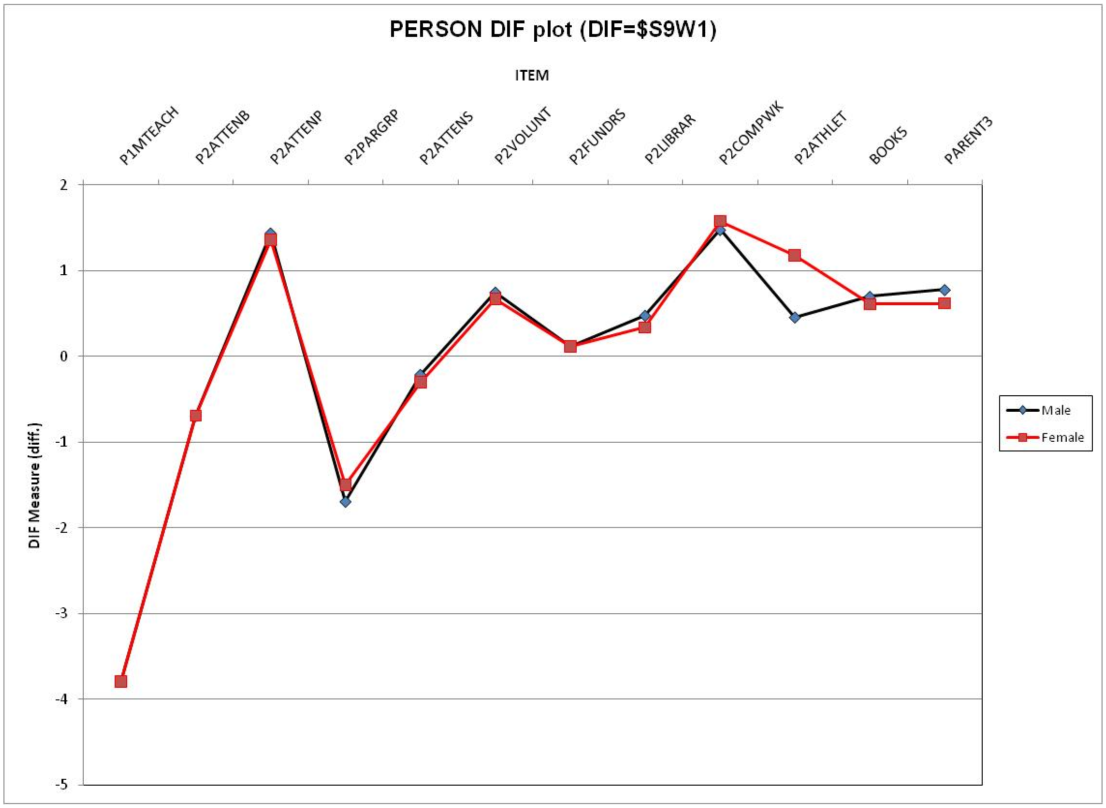

Figure 6. Differential Item Functioning (DIF) at Kindergarten Wave

Table 33

Differential Item Functioning (DIF) Summary Statistics at First-grade Wave

ID	Item	DIF Contrast	t	p value
1	MTEACH	0.00	0.00	1.00
4	ATTENB	-0.05	-17.3	<0.001
5	ATTENP	-0.06	-26.9	<0.001
6	PARGRP	0.00	0.00	1.00
7	ATTENS	0.00	0.00	1.00
8	VOLUNT	0.10	43.69	<0.001
9	FUNDRS	0.08	33.95	<0.001
11	LIBRAR	0.07	31.02	0.001
12	COMPWK	0.00	0.00	1.00
14	ATHLET	0.00	0.00	1.00
24	BOOK5	0.00	0.00	1.00
25	PARENT	0.00	0.00	1.00

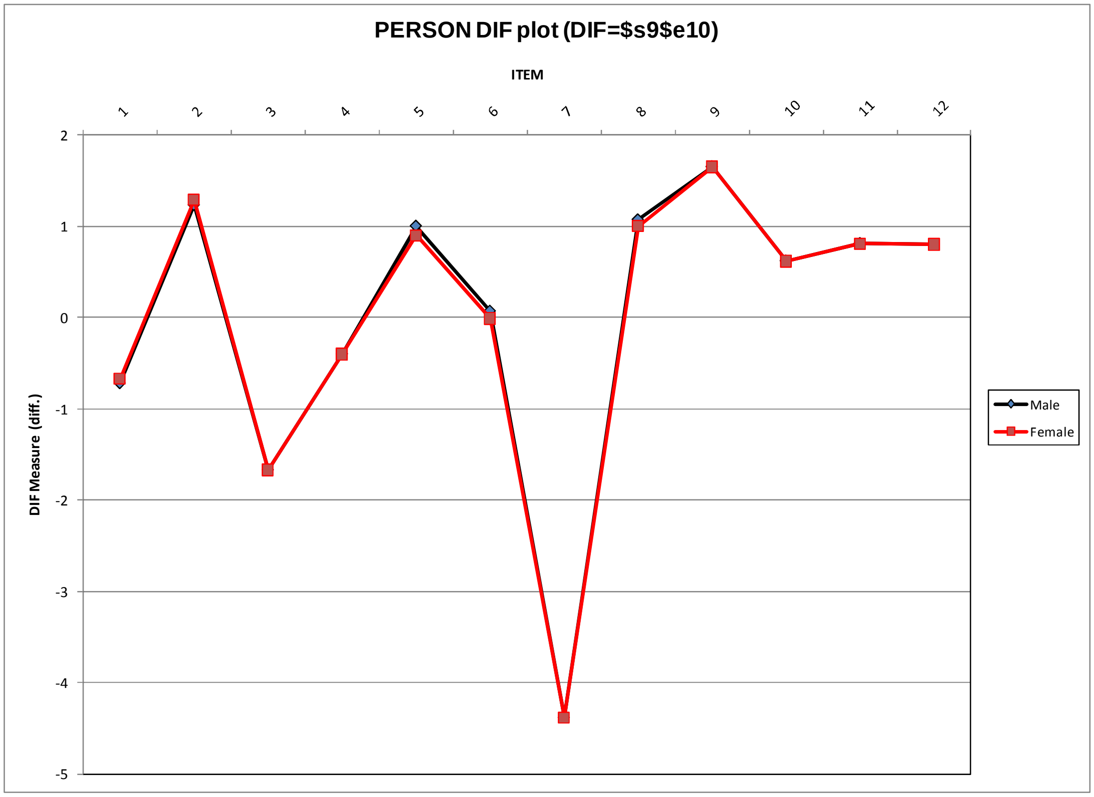

Figure 7. Differential Item Functioning (DIF) at First Wave

Table 34

Differential Item Functioning (DIF) Summary Statistics at Kindergarten Wave

ID	Item	DIF Contrast	t	p value
1	MTEACH	0.18	17.24	<0.001
4	ATTENB	-0.09	-27.2	<0.001
5	ATTENP	0.00	0.00	1.00
6	PARGRP	-0.02	-5.2	<0.001
7	ATTENS	0.00	0.00	1.00
8	VOLUNT	0.07	29.67	<0.001
9	FUNDRS	0.00	0.00	1.00
11	LIBRAR	0.06	25.24	<0.001
12	COMPWK	0.00	0.00	1.00
14	ATHLET	-0.05	-19.8	<0.001
24	BOOK5	0.00	0.00	1.00
25	PARENT	0.06	27.28	<0.001

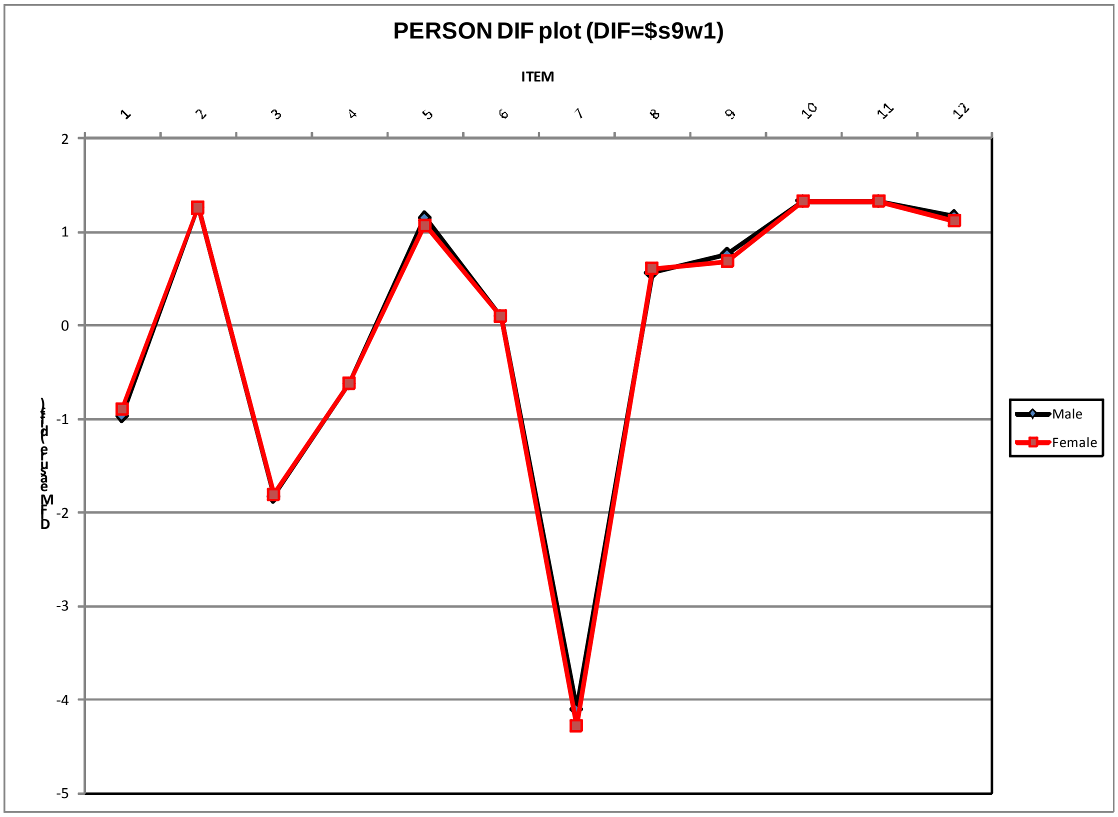

Figure 8. Differential Item Functioning (DIF) at Third Wave

Table 35

Differential Item Functioning (DIF) Summary Statistics at Kindergarten Wave

ID	Item	DIF Contrast	t	p value
1	MTEACH	-0.60	-7.51	0.003
4	ATTENB	0.11	38.18	<0.001
5	ATTENP	0.09	37.96	<0.001
6	PARGRP	0.22	62.85	<0.001
7	ATTENS	0.00	0.00	1.00
8	VOLUNT	0.04	18.99	<0.001
9	FUNDRS	0.00	0.00	1.00
11	LIBRAR	0.00	0.00	1.00
12	COMPWK	-0.07	-52.7	<0.001
14	ATHLET	-0.06	-25.6	<0.001
24	BOOK5	0.00	0.00	1.00
25	PARENT	0.00	0.00	1.00

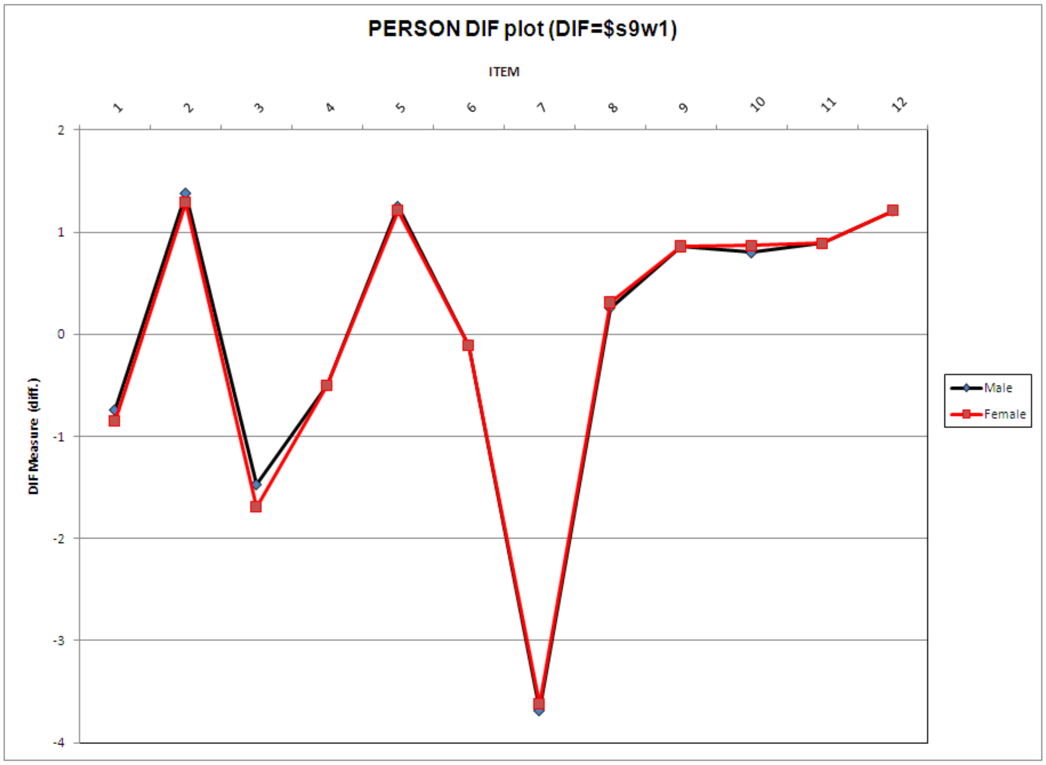

Figure 9. Differential Item Functioning (DIF) at Fifth Wave

Part V: Multiple Regression

The scaled scores of three domains of parent involvement at each wave were used to predict students' reading and mathematics performance at four waves, respectively. The results indicated that school/home involvement correlated positively with school performance, including both reading and mathematics scores, at kindergarten-spring, first, third, and fifth grade (Table 36). The effect size suggested a strong relationship between students' reading and parents' school/home involvement at third and fifth grade. The domain of home educational investment highly related to students' reading at kindergarten-spring and third grade, and the relationship at third grade was medium. The domain of family routines negatively related to students' reading at third and fifth grade, and the effect size was small. Table 36 and 37 provide the results of multiple regression at each data analysis wave.

Table 36

Predictive Models of Students' Reading Achievement at Each Data Analysis Wave

School Year					
Kindergarten-spring	Estimated	Standardized	t value	p value	Cohen's d
School/Home	.477	.084	5.700	<0.001	0.17
Educational Investment	-.171	.073	-2.327	0.020	0.15
Family Routines	.071	.046	1.549	0.122	
Reading at k-fall	1.129	.015	77.751	<0.001	0.03
$F_{(4, 433)}$=1827.27, R^2=.695, p<0.001					

First	Estimated	Standardized	t value	p value	Cohen's d
School/Home	2.515	0.195	12.881	<0.001	0.4
Educational Investment	0.185	0.165	1.124	0.262	
Family Routines	-0.069	0.124	-0.556	0.578	
Reading at k-spring	1.423	0.032	44.700	<0.001	0.06
$F_{(4, 433)}$=721.805, R^2=.474, p<0.001					

Third	Estimated	Standardized	t value	p value	Cohen's d
School/Home	3.365	0.305	61.407	<0.001	0.65
Educational Investment	0.664	0.167	11.021	<0.001	0.35
Family Routines	-0.139	0.115	3.966	<0.001	0.23
Reading at first	0.780	0.013	-1.21	0.227	0.03
$F_{(4, 445)}$=1513.38, R^2=.576, p<0.001					

Fifth	Estimated	Standardized	t value	p value	Cohen's d
School/Home	1.573	0.361	4.357	<0.001	0.76
Educational Investment	0.108	0.159	0.677	0.499	
Family Routines	-0.239	0.121	-1.98	0.048	0.25
Reading at third	0.770	0.011	69.071	<0.001	0.03
$F_{(4, 445)}$=1628.60, R^2=.752, p<0.001					

Table 37

Predictive Models of Students' Mathematics Achievement at Each Data Analysis Wave

School Year					
Kindergarten-spring	Estimated	Standardized	t value	p value	Cohen's d
School/Home	0.623	0.077	8.108	<0.001	0.15
Educational Investment	-0.055	0.067	-0.818	0.414	
Family Routines	-0.025	0.041	-0.603	0.547	
Reading at K-fall	1.039	0.013	77.595	<0.001	0.03
$F_{(4, 433)}$=1899.70, R^2=.676, p<0.001					
First	Estimated	Standardized	t value	p value	Cohen's d
School/Home	1.842	0.161	11.452	<0.001	0.33
Educational Investment	-0.071	0.109	-0.651	0.516	
Family Routines	-0.078	0.074	-1.049	0.205	
Reading at K-fall	1.279	0.021	60.963	<0.001	0.04
$F_{(4, 433)}$=1110.33, R^2=.522, p<0.001					
Third	Estimated	Standardized	t value	p value	Cohen's d
School/Home	2.067	0.240	8.627	<0.001	0.50
Educational Investment	-0.049	0.160	-0.307	0.758	
Family Routines	0.017	0.101	0.166	0.868	
Reading at K-fall	0.965	0.015	66.426	<0.001	0.03
$F_{(4, 445)}$=1557.10, R^2=.605, p<0.001					
Fifth	Estimated	Standardized	t value	p value	Cohen's d
School/Home	1.353	0.173	7.801	<0.001	0.35
Educational Investment	0.089	0.148	0.603	0.548	
Family Routines	0.030	0.100	0.306	0.761	
Reading at K-fall	0.851	0.015	58.184	<0.001	0.03
$F_{(4, 445)}$=1092.70, R^2=.757, p<0.001					

Since the item for assessing parents' expectations for their children's education was eliminated due to a low factor loading in EFA, the researcher conducted a series of multiple regression using parental expectation as a predictor of children's performance in school in order to understand the influence of parental expectations. The results indicated that the domain of parents' expectations positively related to students' reading and mathematics achievement at third-grade wave. These values suggested that parents had higher expectations regarding their children's education at third grade, their children performed better in their reading and mathematics at that time.

Table 38

The Impact of Parental Expectations Students' Academic Achievement at Each Data Analysis Wave

Year		Sample Size	Estimated	Standardized	t value	p value
Kindergarten-spring	Reading	5,768	0.021	0.254	0.082	0.935
	$F_{(2, 406)}$=1326.52, R^2=.687, p<0.001					
	Math	6,103	-0.141	0.211	-0.669	0.504
	$F_{(2, 414)}$=1907.67, R^2=.674, p<0.001					
First	Reading	5,878	-0.49	0.635	-0.771	0.441
	$F_{(2, 412)}$=863.536, R^2=.559, p<0.001					
	Math	6,078	.191	0.374	.510	0.610
	$F_{(2, 414)}$=1912.23, R^2=.588, p<0.001					
Third	Reading	6,617	3.418	0.422	8.093	<0.001
	$F_{(2, 406)}$=1590.34, R^2=.550, p<0.001					
	Math	6,749	2.257	0.405	5.56	<0.001
	$F_{(2, 418)}$=2284.84, R^2=.609, p<0.001					
Fifth	Reading	6,044	-.357	0.554	-.644	0.52
	$F_{(2, 416)}$=1802.79, R^2=.711, p<0.001					
	Math	6,050	.364	0.458	.794	0.428
	$F_{(2, 416)}$=1648.38, R^2=.759, p<0.001					

Part VI: Latent Growth Modeling (LGM)

Before investigating the impact of three domains of parent involvement on school performance, the researcher examined the growth models of students' reading and mathematics abilities from kindergarten through the fifth grade. The growth models contained four time points, including the fall of 1998 (kindergarten-fall), the spring of 2000 (first), the spring of 2002 (third), and the spring of 2004 (fifth), and the initial status was set at kindergarten-fall. Hypothesized models were examined and compared the goodness of fit using CFI and RMSEA, including a linear growth curve model with fixed intercepts and slope (model 1) (Figure 10), a linear growth curve model with fixed intercepts and free time scores (model 2) (Figure 11), a linear growth curve model with free intercepts and fixed slope (model 3) (Figure 12), a piecewise model (model 4) (Figure 13), and a quadratic model (model 5) (Figure 14).

Table 39

Fit Indices of Hypothesized Models

Reading Growth Model	Observations	$\chi^2_{(df)}$	RMSEA	CFI
Model 1[a]	8,341	$2739.579_{(5)}$	.256	.463
Model 2[a]	8,341	$531.108_{(3)}$	.145	.896
Model 3[b]	8,341	$236.299_{(0)}$	<.001	.954
Model 4[a]	8,341	$0.001_{(0)}$	<.001	1.000
Model 5[a]	8,341	$686.007_{(1)}$	.866	.287
Mathematics Growth Model	**Observations**	$\chi^2_{(df)}$	**RMSEA**	**CFI**
Model 1	8,348	$1861.957_{(5)}$	.211	.707
Model 2[a]	8,348	$191.163_{(3)}$	.087	.970
Model 3	8,348	$64.096_{(3)}$	.049	.990
Model 4[c]	8,348	$870.036_{(1)}$	.323	.863
Model 5[a]	8,348	$187.098_{(1)}$	.149	.971

a. The residual covariance matrix (theta) is not positive definite.
b. The standard errors of the model parameter estimates may not be trustworthy for some parameters due to a on-positive definite first-order derivative product matrix. This may be due to the starting values but may also be an indication of model nonidentification.
c. The latent variable covariance matrix (psi) is not positive definite.

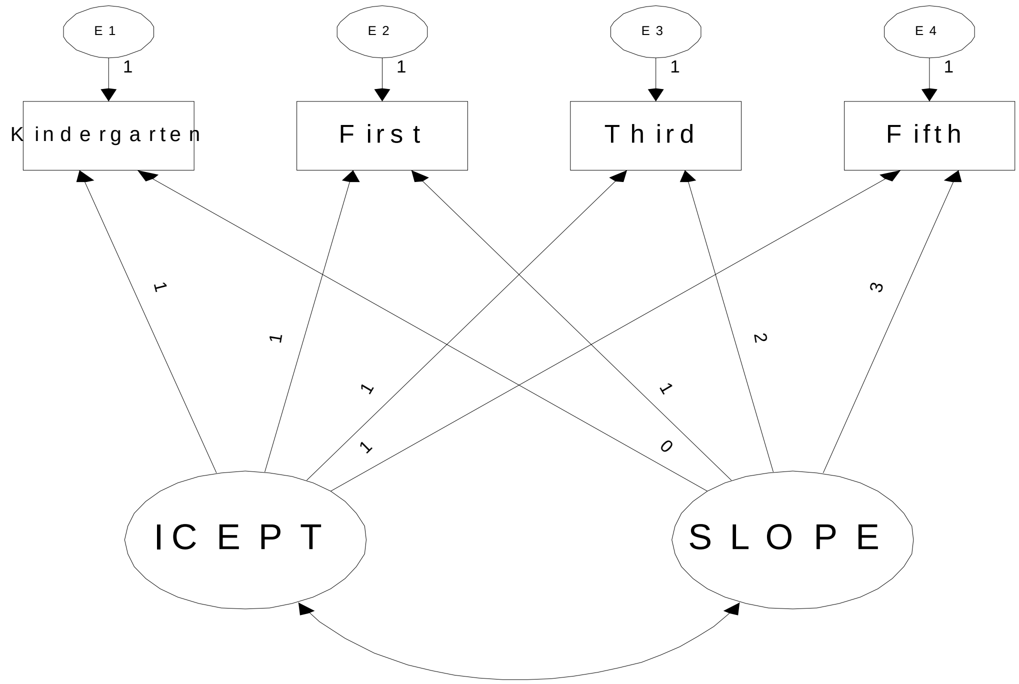

*Figure 10.*A Linear Growth Model with Fixed Intercepts and Slopes

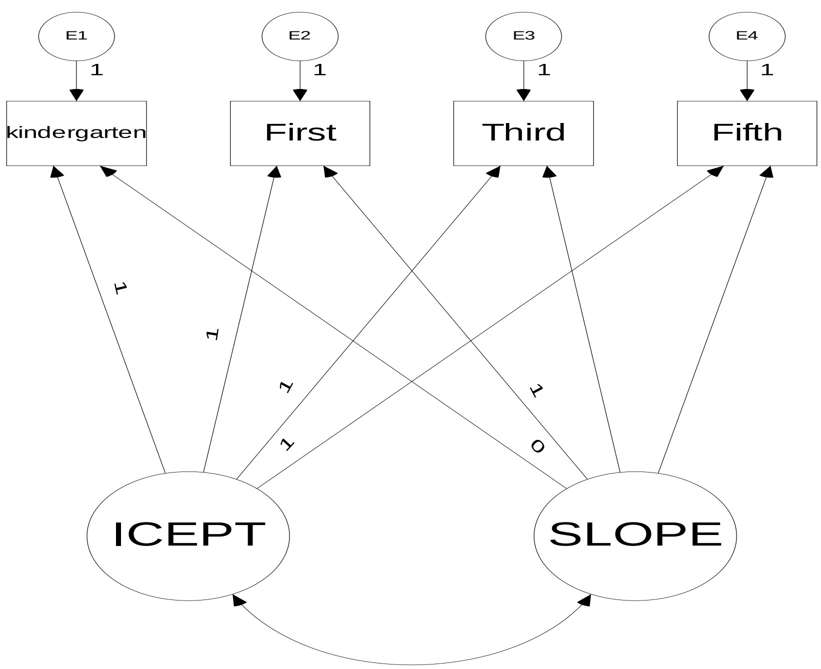

*Figure 11.*A Linear Growth Model with Fixed Intercepts and Free Slopes

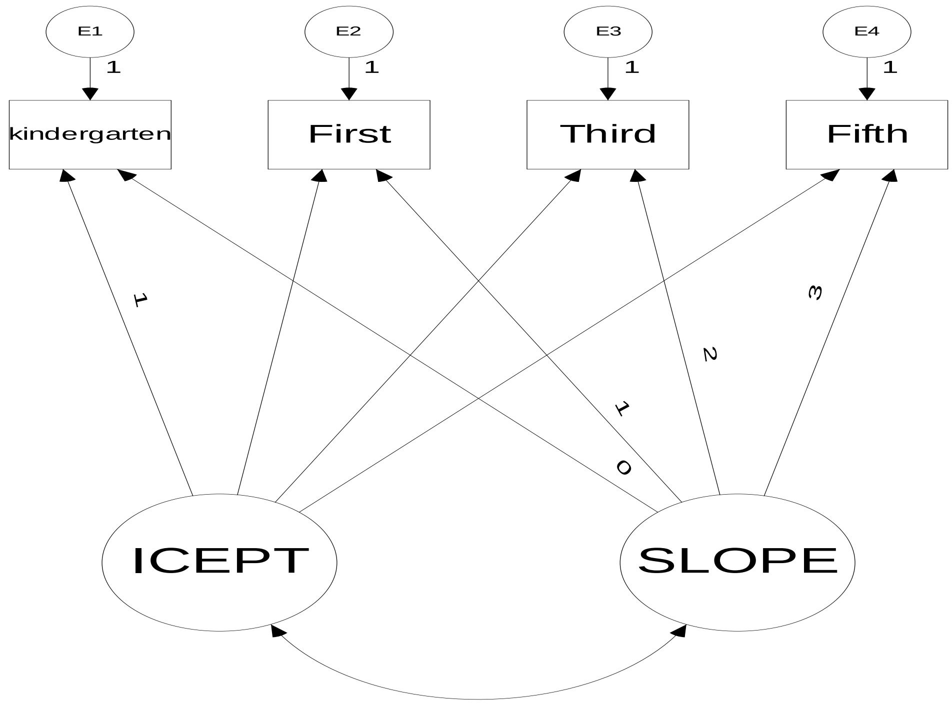

*Figure 12.*A Linear Growth Model with Free Intercepts and Fixed Slopes

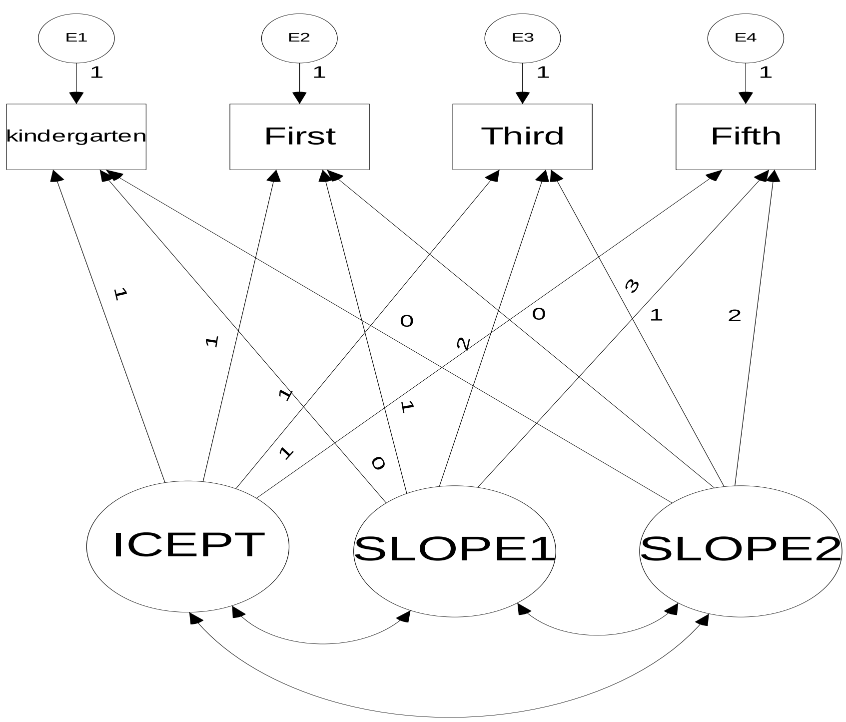

*Figure 13.*A Piecewise Growth Model

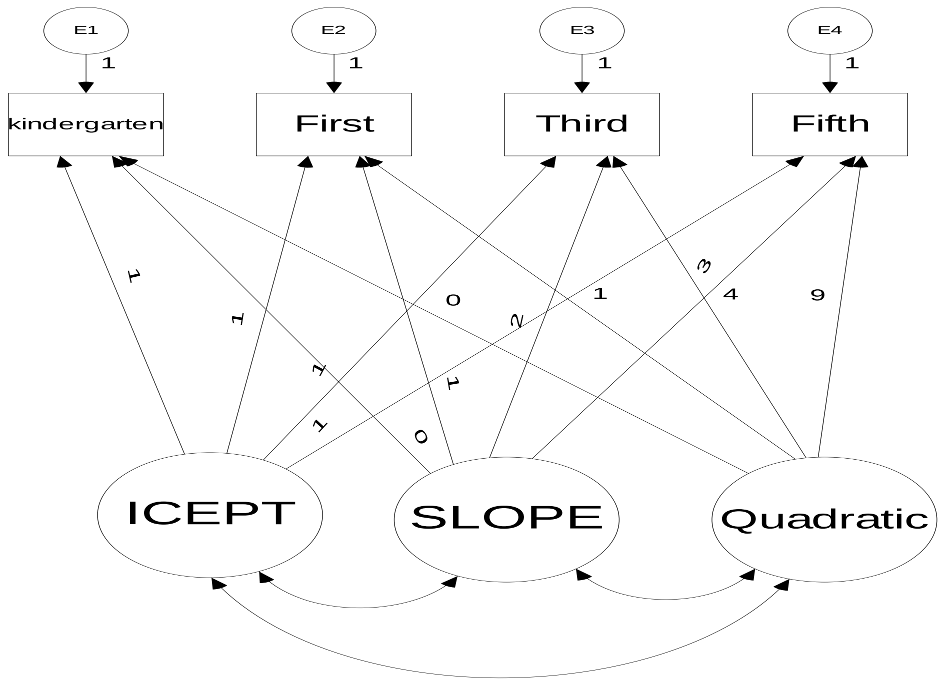

Figure 14. A Quadratic Growth Model

Fit indices indicated that the model 3 fit the data of children's mathematics progress best with CFI greater than .90 and RMSEA less than 0.05 (Table 39). This model was determined as a null model of mathematics growth and then, the regression weights of intercepts were fixed as the null suggested for examining the longitudinal influence of three domains of parent involvement (Figure 15). The results of Table 40 suggested that the domains of school/home involvement and home educational investment correlated positively to the intercept whereas these two domains were negatively related to the slope. However, the domain of family routines was not correlated to both the intercept and the slope. Additionally, the researcher examined the association between parental expectations and mathematics growth (Figure 16), and the results suggested that parental expectations positively related to the intercept whereas negatively correlated to the slope (Table 40).

Five hypothesized models for children's reading progress were examined as well. The results suggested model 3 and 4 fit the data well (RMSEAs<0.05, CFIs>0.90). However, the outputs of Mplus displayed warning messages indicating a problematic model and the results were not trustworthy. It was concluded that these five models did not demonstrate a significantly acceptable model fit, and this study failed to determine the reading growth model from kindergarten through the fifth grade. Therefore, the study did not conduct further data analysis to examine the longitudinal impact of parent involvement on children's progress in their reading achievement.

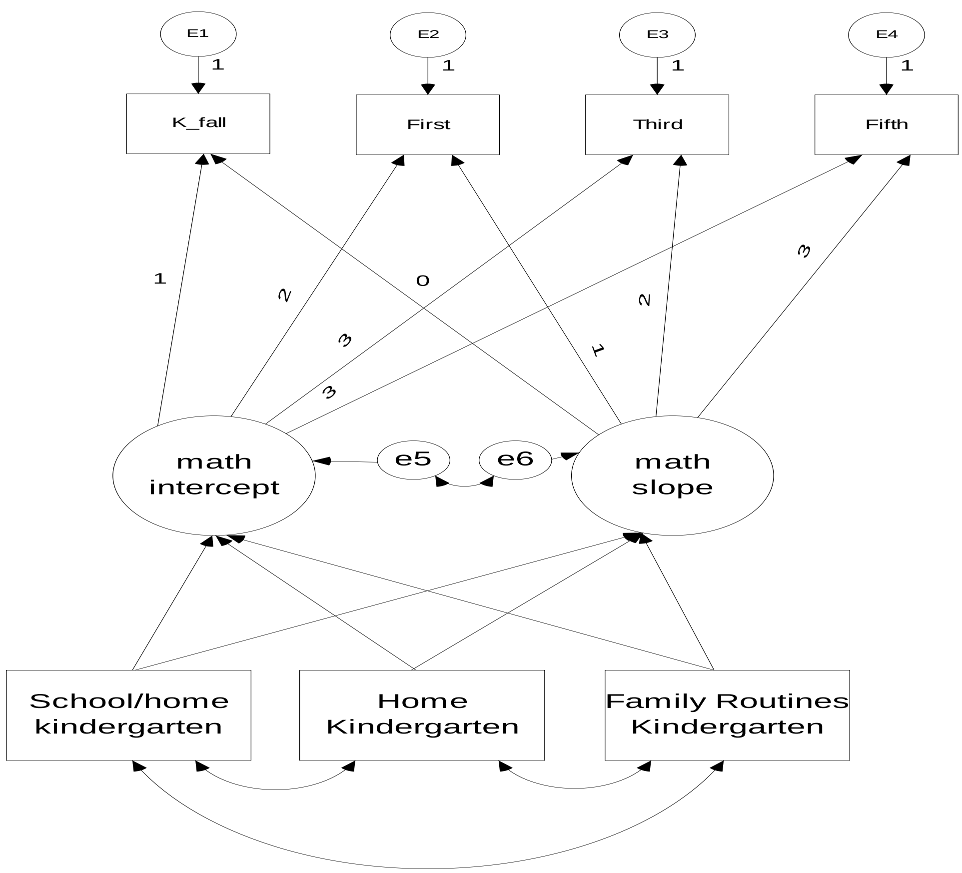

Figure 15. Mathematics LGM Predicted by Three Domains of Parent Involvement

Table 40

Children's Mathematics Achievement LGM Model

Parameter	Unstandardized estimates	Standardized estimated
Model 1: Three domains of parent involvement and children's math		
Variables loadings on Math		
School/Home→Intercept $_{math}$	2.832***	.376
Home educational investment→Intercept $_{math}$	.692**	.092
family routines→Intercept $_{math}$	-.167	-.036
family routines→Slope $_{math}$	.033	.006
School/Home→Slope $_{math}$	-.377*	-.073
Home educational investment→Slope $_{math}$	-6.336	-.160
Covariance		
Intercept $_{math}$ with Slope $_{math}$	-13.908***	-.357
family routines with School/Home	.393***	.141
Family routines with Home educational investment	.062	.062
School/Home with Home educational investment	.141*	.141
Intercept/Mean		
School/Home	.552***	.552
Home educational investment	-2.128	-2.128
family routines	.815***	1.230
Model fit: CFI=0.990, RMSEA=.034, $\chi^2(df = 9) =$	94.111	p<0.001
Model 2: Parental expectations and children's math		
Variable loadings on math		
parental expectations→Intercept $_{math}$	4.34***	.578
parental expectations→Slope $_{math}$	-.466*	-0.091
Covariance		
Intercept $_{math}$ with Slope $_{math}$	-15.788***	-.412
Model fit: CFI=0.991, RMSEA=.039, $\chi^2(df = 5) =$	69.039	p<0.001

*p<0.05, **p<0.01, ***p<0.001.

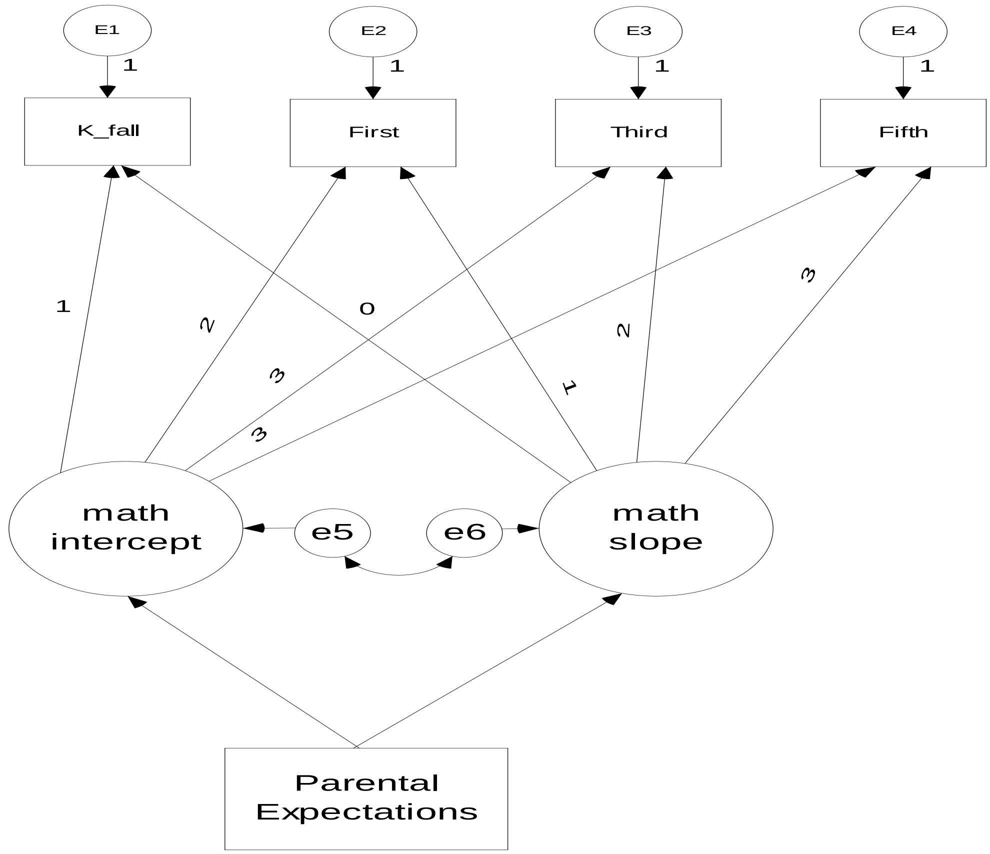

Figure 16. Mathematics LGM Predicted by Parental Expectations

Chapter IV

Discussion

Educators and policy makers have endorsed parent involvement as one of the most influential factors to promote children's academic achievement and advocated that schools should encourage parents to get more involved in their children's education. However, the influence of parent involvement has not been evident in previous research due to various definitions of parent involvement and approaches to assess the construct. Chaotic definitions of parent involvement, leading to discrepant measures to assess parent involvement, have yielded inconsistent findings about how beneficial parent involvement is to students' academic achievement. Even though most researchers believe that highly-involved parents contribute to their children's high levels of performance in school, other researchers reported mixed findings, including either small effects on child development or negative relations between parent involvement and children's academic achievement. Identifying items to assess parent involvement is crucial in order to understand the structure of parent involvement and its longitudinal influence on children's performance.

The primary goal of this study was to investigate items used to assess parent involvement in the United States. Both CTT and MIRT were used in this study to explore the longitudinal factor structure of 25 items from the ECLS-K dataset. This study also examined the influence of parent involvement on children's reading and mathematics scores at kindergarten, first, third, and fifth grade, as well as its longitudinal impact on children's growth in reading and mathematics achievement from kindergarten to the fifth grade. The ECLS-K dataset provided information from the kindergarten cohort in the fall of 1998 and the spring of 1999, and recruited participants in the spring of 2000 when children were first-graders. Due to the design effect of multistage sampling and over-sampling of Asian and Native Americans, the researcher used weights, cluster, and strata variables provided in the dataset to adjust the estimates of parameters on the basis of the types and the time of data used in each data analysis. Additionally, since the ECLS-K is a longitudinal study and some data are not available at all data collection wave, the sample size in the present study varied at each data analysis wave as well as varied in different data analyses methods.

The criteria for item selections were established either by previous studies using the ECLS-K dataset to investigate parent involvement or by published theories or models in the parent involvement field. According to Miller, Zhang, Ani and Chen's (2009) findings, parent involvement has been reliably measured and presented as a total of eight domains, including school involvement, home involvement, family routines, communication between parents and schools, parents' aspirations, parental efficacy beliefs, parent information network, and a positive relationship between parents and schools. They also found that before 2000, most studies investigated fewer domains of parent involvement, but recent studies measured a wider range of parent involvement domains. These findings coincided with the transition of theories of parent involvement from a single construct to a multi-dimensional construct. In addition, these authors indicated that none of these studies have investigated all of these eight domains, and most of the representative studies examined key attributes of four domains of parent involvement. These findings revealed a lack of an appropriate measure to assess parent involvement. Thus, this study selected items to assess eight domains of parent involvement initially and focused on items measured across kindergarten, first, third, and fifth-grade waves. The exploration of the item content across waves yielded a total of 25 items covering seven out of eight domains of parent involvement.

With respect to developing a measure of parent involvement, researchers have conducted CTT to examine specific elements of parent involvement using either EFA or CFA, but they have not documented any measures using an IRT approach. Inferences of findings in parent involvement research might be restricted by the limitations of CTT because it heavily depends on the characteristics of samples in a study, focuses on item fit, and is sample dependent. Also, researchers often used an ordinal or categorical scale/item to assess parent involvement and treated non-interval data as interval to perform data analyses. This might result in biased estimates in data analyses because most statistical techniques assume normality and linearity in order to obtain a stronger solution. Therefore, this study used both CTT and IRT approaches to identify optimal items to measure parent involvement. The combinations of these two methods provide more information about the factor structure of parent involvement as well as item and person fit. Further, scores of each domain of parent involvement were transformed from a categorical scale to an interval scale using a Rasch model approach. The IRT scaled scores were used to predict children’s academic achievement, providing more accurate estimates of the impact of parent involvement on children’s academic achievement and their growth rate in reading and mathematics achievement from kindergarten through elementary school years.

Participants in the present study were parents who completed these 25 chosen items (named the completed group). Compared to parents who did not respond all of these 25 items (named the missing group) in their children's ages, gender, ethnicity, and family SES, the results indicated that this study had more participants at the group of 111 months and less than 114 months at third-grade wave. Regarding children's gender, even though the results revealed statistically significant differences in children's gender at kindergarten and first wave because the gender information of very a few participants in the missing group was not available, it was concluded that children's gender in two groups were not significantly different and this factor was ignorable. The results of composites of ethnicity in two groups suggested that the missing group had more Black, Hispanic, and Asian groups compared to the completed groups across four time points. At both kindergarten and first wave, the majority of the missing group was from the first and the second quintile SES, and the completed group had more families from the fourth and the fifth quintile SES. Also, the results of the completed group at kindergarten, first, and third wave suggested that the completed group at third wave consisted of more participants from the highest and the lowest SES groups compared to kindergarten wave. These findings suggested that the missing group contained more low-income families whereas the completed group included more higher-income families at these two waves. Thus, participants in this study consisted of higher proportions of Caucasian American families and more high-income families, and findings in this study would be more appropriate for inferring to these groups.

The first objective of this study was to identify items to assess parent involvement from kindergarten through elementary school years. Three data analyses were accomplished to answer this question, including experts' reviews, factor analysis, and IRT approaches. Content validity and appropriateness of categorizations for each item of intended domains were assessed through experts' reviews. Exploratory factor analysis served to discover the factor structure of parent involvement and the findings were validated through confirmatory factor analysis and multidimensional item response theory. Rasch model analyses were then used to examine the quality of each item, person fit, and reliability of item and person separation. Further, the Rasch model was use for transforming parents' responses from categorical data to interval data in order to examine the influence of parent involvement on students' academic achievement.

The results of experts' reviews suggested a multi-dimensional construct of parent involvement, which can be captured by activities in school and at home, parental attitudes toward their children's education, communication between schools and parents, relation between parents and schools, parents' aspirations, and parental networking. All experts agreed that parent involvement consists of seven domains defined in this study, and none of them suggested adding more items to represent the other domains of parent involvement, such as parental efficacy beliefs, into this study. These seven domains are consistently recognized as components of parent involvement and measured across prior research studies, and the domain of parental efficacy beliefs was the least frequently measured in previous research (Miller, Zhang, Ani, & Chen, 2009). Parental self-efficacy is related to the degree of parental belief in their contributions to children's success in school, and it motivates whether or not parents get involved in children's education (Hoover-Dempsey & Sandler, 1997; Walker et al., 2005). According to Hoover-Dempsey's and Sandler's model, parents' behavioral choices are guided in part by the outcomes they expect to follow their actions. When parents have reasonable confidence in their ability to help children, their confidence, in turn, has been associated with involvement (e.g., Ames, 1993; Balli, Demo, & Wedman, 1998). Therefore, parental self-efficacy can be inferred as an accelerant of parent involvement, but it is not a component of parent involvement.

The results of experts' reviews also indicated discrepant definitions of home involvement and communication between schools and parents. The most controversial definition was home involvement. One expert argued items of the domain of home involvement are used to assess children's actions but not to assess specific attributes of parent involvement. Even though parents, sometimes, need to pay for these activities, practice with their children, and spend time transporting children, these questions do not specify components of parent involvement at all. Additionally, the domain of family routines is one component of home educational investment, argued one expert, because family routines represent home educational investment through family positive involvement and structure. One expert proposed that communication between parents and schools contains the amount of contacts between the family and school and the quality of one-way versus two-way interactions, indicating an overlap of these two domains. However, the item-domain agreements of both domains of communication and relation did not reflect this overlapping meaning. Average expert rating of appropriateness of categorization of items for these two domains was 5, indicating high agreement about appropriateness of categorizations of items for the domain of communication between parents and schools and for the domain of relation between schools and parents.

Despite arguments about definitions of parent involvement, most items for intended domains of parent involvement were consistently endorsed by expert panels. The overall mean item-domain agreement was 4.62 using a five-point rating scale where 1=very inappropriate and 5= very appropriate, a high value regarding categorization of items among experts. An average score of item-domain agreement regarding categorization of 5 was obtained for the domains of school involvement, communication between schools and parents, relation between parents and schools, and parents' aspirations. The means indicated all four experts endorsed these items as useful for assessing four domains of parent involvement. An average score of networking was 4.75, followed by average scores of 4.36 for the domain of home involvement. The lowest score was 3.22 for the domain of family routines because one expert suggested recategorizing these items into the home involvement domain and rated categorization 1, indicating very inappropriate, for all questions within the family routines domain.

The results of EFA with, initially, 25 items suggested a two-, three-, and four-factor solution fit the data better than one-factor solution with RMSEA less than 0.05. A two-factor solution was made by one dimension describing parents' participation in school activities and children's extracurricular activities and the other containing family routines. The total number of items was 21, and a two-factor solution did not include items about parental aspirations, contacting schools, not feeling welcomed by the school, and children's participation in organized clubs. A three-factor solution consisted of 20 items with removal of one item, "how many days eat breakfast together", compared to a two-factor solution. A four-factor solution failed to meet the requirement that more than three items should load on one factor, and the researcher did not perform further examination of this model. Therefore, only the two-factor and the three-factor model were tested at kindergarten, first, third, and fifth wave using CFA and MIRT.

Both CFA and MIRT yielded the same result and suggested that the three-factor model fit the data best. The first dimension of the three-factor model was defined as school/home involvement. This dimension included twelve items, such as “Have you met your child’s teacher yet?” “During this year, have you or another adult in your household attended an open house or a back-to-school night?” The second dimension, home educational investment, consisted of items about children’s participation in dance lessons, organized clubs or recreational programs, like scouts, music lessons (e.g., piano, instrumental music or singing lessons), art classes or lessons (e.g., painting, drawing, and sculpturing), and organized performing arts programs, such as children’s choirs, dance programs or theater performances. The third dimension was named as family routines, combining information about the number of days the children has breakfast at a regular time, the number of days the evening meal is served at a regular time, and the number of days the family eats the evening meal together. These items of a three-factor solution covered five domains initially defined by this study, but the item for assessing the domain of parental aspirations and the item for assessing relation between parents and schools were dropped due to low factor loadings using a cutoff value of 0.3. The first domain, school/home involvement, combined items initially defined for assessing the domains of school involvement, communication between schools and parents, networking, and part of items of home involvement. The second domain contained items to assess resources investment within the domain of home involvement. The family routine domain included three out of five items which were initially used to assess the domain of family routines. Therefore, the longitudinal factor structure of parent involvement from kindergarten to the fifth grade using both CFA and MIRT approaches was determined as a three-factor model representing the domains of school/home involvement, home educational investment, and family routines.

The longitudinal structure of parent involvement was examined in the present study through structural invariance tests. Structural invariance concerns how the latent factors are distributed and concerns the extent to which are the psychometric properties of the observed indicators are transportable (generalizable) over time. This present study examined all factor invariance models and found that the three-factor structure of parent involvement did exist from kindergarten through elementary school years. Fit indices indicated that a configure, a metric, a scalar, and a residual variances model demonstrated an appropriate model fit with CFI around 0.9 and RMSEA less than 0.05. The values of CFI difference tests for comparing pairs of invariance models were less than 0.01, and it was concluded that factor invariance was established (Hu & Bentler, 1998). Thus, the longitudinal factor structure of parent involvement from kindergarten through the fifth grade was determined as a three-factor model.

Item information of parent involvement, which was ignored in previous research, was carefully examined in the present study. Both MIRT and a Rasch model approaches were conducted to check item fit. The results of MIRT indicated that all 20 items displayed acceptable item fit across four time points using both significant item misfit based on the absolute value of t greater than 1.97 and the weighted MNSQ out of the range between 0.75 and 1.33. A Rasch model was used to examine items within each of the three dimensions, respectively. The item fit statistics suggested that items for the school/home involvement and home educational investment domains demonstrated satisfactory fit, as suggested by MIRT. However, even though the overall item fit was considered satisfactory for the domain of family routines, the results of Rasch analysis indicated that the item, “The number of days the child has breakfast at a regular time” demonstrated significant misfit across four time points; “the number of days the evening meal is served at a regular time” had misfit at first and third-wave; “the number of days your family eats the evening meal together?” demonstrated misfit at the third-year wave. It was noticeable that all three items of the family routines domain revealed statistically significant misfit at the third wave.

Rasch model analysis was performed to examine reliability of items assessing the three dimensions. The results revealed that the items of the school/home involvement were relatively easy for parents to endorse and the items adequately measured all levels, exclusive of the highest level, of school and home involvement. It was concluded that reliability supported a fair degree of replicability of person placement for assessing and discriminating between individuals along the parents’ school/home involvement continuum. For the domain of home educational investment, items demonstrated low internal consistency (alpha ranged from .47 to .51) and a value of 0.00 for both person reliability and person separation. Over 80% of parents across four waves reported their children did not take dance lessons and music lessons. Although more children participated in organized clubs and organized performing, and attended art lessons as they grew up, at least 70% of parents answered “No” on these items at four waves. These findings indicated that the items did not adequately measure the levels of home educational investment and failed to capture parents’ time and resource investment which are linked to children's performance at school in childhood. Items for assessing the domain of family routines were relatively easy for parents to endorse and created a significant ceiling effect because half of parents served breakfast and the evening meal at a regular time, and the family had dinner together at least six days per week. Additionally, the second and the third domain of parent involvement consisted of 5 and 3 items, respectively. Thus, the results indicated there were not enough items spread along the continuum of home educational investment and family routines, and further, a total number of 20 items was not able to draw a comprehensive picture of parent involvement from kindergarten to the fifth grade.

The step structure and invariance of items of children's gender were tested via Winsteps software. The rating scale diagnostics were examined to determine whether or not the categories were functioning as intended. The step calibration statistics revealed all 20 items displayed adequate category step structure. The researcher performed DIF of children's gender on items of school/home involvement. The item, "Outside of school hours, has child ever participated in organized athletic activities, like basket ball, soccer, baseball, or gymnastics" functioned differentially across children's gender at the kindergarten wave. Parents having girls were more likely to agree with the statement when their children were in kindergarten. However, this item showed neither problematic item fit nor problematic step calibration and it was not recommended removing from the domain of school/home involvement. The item was retained within the school/home involvement domain when investigating the influence of parent involvement on children's achievement.

Overall, it can be concluded that parent involvement as measured by these 20 items has a three-factor structure, including school/home involvement, home educational investment, and family routines, across kindergarten through elementary school years based on the findings from the ECLS-K dataset. These items have sufficient content validity according to experts and it appears that twelve of the twenty items can reliably measure the domain of school/home involvement in middle childhood. Items for assessing the domain of home educational investment need to be revised in order to accurately represent parents' investment in time and resource during childhood. Also, it is necessary to add enough items to measure family routines. Thus, it is recommended that the three-factor model of parent involvement be retained but that the items assessing the latter two factors be revised to include more appropriate items in order to understand family investment related to children's education, and restrictions on TV, privileges, homework and being with their friends and after school supervision during childhood.

The second study objective was to investigate the influence of parent involvement on children's reading and mathematics achievement as well as on children's growth in these two academic areas. The domain of school/home involvement positively predicted students' academic achievement at kindergarten, first, third, and fifth grade, and its impact was increasing as children grew up in the basis of increasing effect size from kindergarten through the fifth grade. The results of latent growth modeling suggested that the domain of school/home involvement was highly related to the intercept of children's mathematics LGM , and slightly negatively related to the slope. Parents' behaviors aimed at supporting the child in school impacted children's performance in school as some researchers suggested (e.g., Epstein, 1991; Epstein, Simon & Salinas, 1997; Sheldon &

Epstein, 2005), and also, it played a significant role in children's progress in academic achievement in the United States.

The domain of home educational investment demonstrated less influence on students' academic achievement and the findings were contradictory. The domain of home educational investment negatively predicted students' reading at kindergarten wave with small effect size, but positively predicted reading achievement at third grade and the intercept of mathematics LGM. A possible reason is that the items assessing parental investment at home did not reflect what parents provided for their children at these ages. Less than one fourth of children participated in these activities at earlier ages, but they became more involved in these activities as they grew up. These findings might reflect, at least in part, the transition of home educational investment from kindergarten through elementary school years, and also provide some evidence of controversial conclusions regarding the influence of home educational investment on students' academic achievement in the parent involvement literature (e.g., Ho & Willms, 1996; Desimone, 2001).

The domain of family routines displayed negative impact on students' reading performance at third and fifth grade, and no influence on mathematics achievement. Half of parents reported a high level of family routines in their families and slightly increases as their children grew up. The increases of family routines led to students' worse performance in reading (e.g., Singh et al., 1995). However, due to a small number of items for assessing family routines in this study and the low reliability, researchers still need to make efforts to recruit more appropriate items to understand how family routines influence children's development.

The influence of parental aspirations on children's academic achievement was examined in this study as well, in order to draw a comprehensive picture of the impact of parent involvement. The item, "How far in school do you expect the child to go?" was removed due to a factor loading less than 0.3 when exploring the factor structure of parent involvement, so it was not included in other data analyses. Therefore, it was tested individually to examine its impact on children's reading and mathematical achievement and the growth rate. The results revealed that parents' aspirations about their children's education positively predicted reading and mathematics achievement at third grade and the intercept of mathematics LGM, and displayed a slightly negative impact on the slope of the growth model. It was concluded that parents' expectations related to children's reading and mathematical abilities. There was a significant relationship between parental aspirations and children's performance in school during childhood.

Previous research has addressed family is one of the most influential systems to provide instruction and support to meet children's major developmental challenges. Educational researchers advocate for cooperation between family and school, and suggest such cooperation can improve U.S. children's academic performance. The findings of this study revealed that parent involvement significantly related to children's progress in reading and mathematics performance from kindergarten to the fifth grade, and various domains of parent involvement demonstrated various impact over time. Data from the ECLS-K dataset suggested the degree of parents' participation in school activities (combining communication between parents and schools), home educational investment aimed at improving children's performance in school, family routines, and parental aspirations of their children's education were significantly correlated to children's academic outcomes in the childhood. Although items used in this study represented most domains of domains of parent involvement, the influence of the remaining two domains was not unexplored in this study, with respect to children's academic achievement. The results suggested that at least, parts of parent involvement domains significantly impact reading and mathematics achievement and growth rate in mathematics using items in the ECLS-K dataset.

In a conclusion, classical test theory (CTT) demonstrated some limitations in measure development of parent involvement. This study using IRT approaches to investigate items for assessing domains of parent involvement provided more information regarding items and persons. Also, the scores of parent involvement were transformed from categorical data into interval data for further data analyses with unbiased estimates to examine the impact of parent involvement on school achievement. These findings provided empirical evidence of the influence of parent involvement and parents' long-term contributions to their children's academic outcomes.

Limitations

There are some limitations when using the ECLS-K dataset to identify optimal items for assessing parent involvement. In order to develop an adequate measure of parent involvement, it is necessary to have parents and experts involved to examine the wording and the content of items during the measure development process; next, these items will be administered to samples of the target parents to collect information for data analyses. However, the primary purpose of ECLS-K was to provide information about American children's development and the environments where they live and learn. Its purpose was not to develop a measure/scale to assess parent involvement in the United

States. These twenty items used in this study represented the initially defined domains of home, school, communication between schools and parents, family routines, and parental networking. Items for assessing parents' aspirations and relation between parents and schools were eliminated due to lower factor loadings and none of items in the ECLS-K dataset was used for assessing the domain of parental self-efficacy. Therefore, this study was limited to examine parts of domains of parent involvement, and the findings did not demonstrate a comprehensive picture of parent involvement.

The second concern of this study was missing data. The results of preliminary analyses indicated that data used in this study was from middle to high SES and Caucasian American families. The usage of weights in the ECLS-K dataset might not be sufficient to compensate for the lack of other groups. The parent-weight variables provided in this dataset were based on whether or not parents completed the Home Environment, Activities, and Cognitive Simulation Questionnaire (HEQ). Items used in this study consisted of the major items of the Parent Involvement Questionnaire (PIQ) and parts of items, such as home educational investment and family routines, came from the HEQ. Even though the ECLS-K dataset provided weights to adjust design effects to increase generalizability, results obtained from this study may not be generalizable to low-income families and minorities in the United States.

The main purpose of this study was to explore the longitudinal factor structure of parent involvement. All items used in this study were consistently measured at the kindergarten, first, third, and fifth waves, so items measured at a specific point of time were not included in this study. For example, the question "How important do you think it is that a child can count to 20 or more?" was appropriate at the kindergarten wave only, and it was not included at other waves. Due to the limited number of items included in the present study, findings of this study did not demonstrate parent involvement at a specific time in childhood, and they were limited to present some information of parent involvement, not comprehensive, from kindergarten through the fifth grade.

The last concern in the study was outcome variables. The ECLS-K gathered experts' opinions and provided empirical evidence for reliability and validity of cognitive assessments, and these efforts contribute to reliable and valid information regarding students' academic achievement. However, different assessments focus on various aspects of children's cognitive abilities, and might yield very different conclusions about children's capabilities. This might result in distinct estimates of parents' influence on students' academic achievement. Therefore, the findings of the present study could only be inferred to specific outcome variables assessed by a specific cognitive assessment.

Recommendations for Future Research

The body of empirical work on parent involvement might be strengthened in several respects. The most critical need is for theoretically and empirically grounded research focused specifically on measure development. Parent involvement is a broad term and is defined as a multi-dimensional construct that encompasses many parental behaviors and attitudes. As stated earlier, it is necessary to include items for assessing all domains of parent involvement as suggested by previous research in order to understand this complex construct. The results of this study suggest that items in the ECLS-K dataset for assessing the domain of home educational investment need to be revised because they did not capture what parents provide for their children in middle childhood. Reliability of items for assessing the domain of family routines can be improved through adding more adequate items. Further, more effort is needed for creating items to measure relationships between parents and schools, communication between two sides, either parent-initiated and teacher-initiated communication versus responses from the other side, and parent information networking since researchers have not well documented the importance of these domains. Table 41 provides suggested items for assessing domains of parent involvement during childhood.

A possible solution for recruiting more items in a study is to equate items. As stated previously, only twenty five items were administrated across four data analysis waves. Some items in the ECLS-K dataset were measured at a specific time point, but they were excluded in the present study focusing on the longitudinal factor structure of parent involvement. With a Rasch model to equate items, researchers can simulate participants' responses to the items they did not answer, and the item pool will be increased. It becomes possible to understand the comprehensive picture of parent involvement in a study.

Lastly, it is recommended that both CTT and IRT be used to develop or investigate items to assess parent involvement when the sample size is satisfactorily large. These two methods provide information about the factor structure of items and reliability, and IRT compensates for the limitations of CTT. The observed and potential benefits of using an IRT approach underscore its findings in person information, examinations of item calibrations, analysis of step structure, and transformation from ordinal/categorical data to interval data for other data analyses. Researchers will be benefit from the combination of both. With an adequate measure, next, researchers and educators will be capable to investigate the influence of parent involvement and develop a successful intervention program to assist children's succeed in school.

Table 41

Suggested Items for Various Domains of Parent Involvement

Domain	**Items**
Home Involvement	Parents spend time working with the child on reading/writing skills.
	Parents review the child's school work.
	Parents look up words in dictionary with the child.
Relation between schools and parents	Parents feel comfortable to talk with the child's teacher.
	Parents enjoy talking to the child's teacher.
	Parents feel the child's teacher cares about the child.
Communication between parents and schools(Two-way interactions)	Parents discuss with the teacher about how the child gets along with his/her classmates.
	Parents talk to the teacher about the classroom rules.
	Parents talk with the child's teacher about school work to practice at home.
	Parents talk to the child's teacher about his/her accomplishments.
	Parents talk to the child's teacher about his/her daily routine.
	The teacher and parents write notes about the child or school activities.
Communication between parents and schools (parent-initiated)	Parents schedule meetings with administrators to talk about problems or to gain information.
Communication between parents and schools (teacher-initiated)	The teacher contacts parents about the child's performance in school.
Family Routines	Parents maintain clear rules at home that the child should obey.
	The child has a regular morning time.
Parents' aspirations	How important is the education in this family?
	How much do you do things to encourage the child's positive attitude toward education (e.g. take him/her to the library, play games to teach child new things, read to him/her, help him/her make up work after being absent)?
Networking	Do you know the first name (or nickname) of any of your child's close friends?
	Do you know the name of any of your child's classmates' parents?

References

Ackerman, T. A. (1994). Using multidimensional item response theory to understand what items and tests are measuring. *Applied Measurement in Education*, *7*, 255-278.

Ames, C. (1993). How school-to-home communication influence parent beliefs and perceptions. *Equity and Choice, 9,* 44-49.

Adams, R. J., Wilson, M., & Wang, W. (1997). The multidimensional random coefficients multinomial logit model. *Applied Psychological measurement, 21,* 1-23.

Baker, D. P., & Stevenson, D. L. (1986). Mother's strategies for children's school achievement: Managing the transition to high school. *Sociology of Education*, *59,* 156-166.

Balli, S. J., Demo, D. H., Wedman, J. F. (1998). Family involvement with children's homework: An intervention in the middle grades. *Family Relations*, *47,* 142-146.

Bobbett, G. C. (1995). *An analysis of Nevada's report cards on high schools.* Paper presented at the Annual Meeting of the Mid-South Educational Research Association. Biloxi, Mississippi, November 8-10. (ERIC Document Reproduction Service No.: ED 397-084).

Bock, R. D., & Aitkin, M. (1981). Marginal maximum likelihood estimation of item parameters: Application of an EM algorithm. *Psychometrika*, *46*, 443-459.

Bodovski, K., & Farkas, G. (2008). "Concerted cultivation" and unequal achievement in elementary school. *Social Science Research, 37,* 903-919.

Bollen, K. A. (1989). *Structural equations with latent variables.* New York: Wiley.

Bond, R. G., & Fox, C. M. (2001). *Applying the Rasch model: fundamental measurement in the human sciences.* Mahwah, New Jersey: Lawrence Erlbaum Associates.

Bourdieu, P. (1977). Cultural reproduction and social reproduction. In J. Karabel & A. H. Halsey (Eds.), *Power and Ideology in Education* (pp. 487-511). New York: Oxford University Press.

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design.* Cambridge: Harvard University Press.

Bronfenbrenner, U. (1993). The ecology of cognitive development: Research models and fugitive findings. In R. H. Wozniak & K. Fischer (Eds.), *Development in context: Acting and thinking in specific environments* (pp. 3-46). Hillsdale, NJ: Erlbaum.

Bronfenbrenner, U. (2001). Environments in developmental perspective: Theoretical and operational models. In S. L. Friedman & T. D. Wachs (Eds.), *Measuring environment across the life span: Emerging methods and concepts (pp. 3-28).* Washington, DC: American Psychological Association.

Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In W. Damon (Series Ed.) & R. M. Lerner (Vol. Ed.), *Handbook of child psychology: Vol. 1. Theoretical models of human development (6th ed. pp.793-828).* Hoboken, N.J.: John Wiley & Sons.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136-162). Newbury Park, CA: Sage.

Caplan, J. (2001). Strengthening the connection between school and home. Essentials for principals. Arlington, VA. (Retrieved March 3, 2007 from Online Source, ERIC No. ED 459 521).

Carpenter, G. J. O. (2005). The school success and adjustment of young African American children. Unpublished dissertation, Miami University, Oxford, OH.

Chao, R. K. (2000). The parenting of immigrant Chinese and European American mothers: Relations between parenting styles, socialization goals, and parental practices. *Journal of Applied Developmental Psychology, 21,* 233-248.

Chou, C. P., & Bentler, P. M. (1995). Estimates and tests in structural equation modeling. In R. H. Hoyle (Ed.), *Structural Equation modeling* (pp. 37-55). Thousand Oaks, CA: Sage.

Christenson, S. L. (1995). Families and schools: What is the role of the school psychologist? *School Psychology Quarterly, 10,* 118-132.

Christenson, S. L., Rounds, T., & Gourney, D. (1992). Family factors and student achievement: An avenue to increase students' success. *School Psychology Quarterly, 7,* 178-206.

Cochran, M. M., Larner, D. R., Gunnarsson, L., & Henderson, C. R. (1990). *Extending Families: The Social Networks of Parents and their Children.* New York: Cambridge University Press.

Cochran, M., & Brassard, J. (1979). Child Development and Personal Social Networks. *Child Development, 50,* 609-616.

Coleman, J. S. (1987). Families and schools. *Educational Researcher, 16,* 32-38.

Coleman, J. S. (1988). Social capital in the creation of human capital. A*merican Journal of Sociology, 94,* 95-120.

Comer, J. P., & Haynes, N. M. (1991). Parent involvement in schools: An ecological approach. *Elementary School Journal, 91*, 271-277.

Cox, J. H., & Witko, C. (2008). School choice and the creation of social capital reexamined. *American Journal of Political Science, 52,* 142-155.

Crozier, G. (2007). Empowering the powerful: a discussion of the interrelation of government policies and consumerism with social class factors and the impact of this upon parent interventions in their children's schooling. *British Journal of Sociology of Education, 18,* 187 - 200.

Dearing, E., Kreider, H., Simpkins, S., & Weiss, H. B. (2006). Family involvement in school and low-income children's literacy: Longitudinal associations between and within families. *Journal of Educational Psychology, 98,* 653-664.

Desimone, L. (2001). Linking parent involvement with student achievement: Do race and income matter? *The Journal of Educational Research, 93,* 11-31.

Deslandes, R., Royer, E., Turcotte, D., & Bertrand, R. (1997). School achievement at the secondary level: Influence of parenting style and parent involvement in schooling. *McGill Journal of Education, 32,* 191-208.

Digest of Education Statistics. (2007). Chapter6: International comparisons of education. http://nces.ed.gov/programs/digest/d07/index.asp

Dimock, C., O'Donoghue, T., & Robb, A. (1996). Parent involvement in schooling: An emerging research agenda. *Compare, 26,* 5-20.

Drillien, C. M. (1957). The social and economic factors affecting the incidence of premature birth. *The Journal of obstetrics and gynaecology of the British Empire, 64,* 161-184.

Duncan, P. W., Bode, R. K., Lai, S. M., & Perera, S. (2003). Rasch analysis of a new stroke-specific outcome scale: The Stroke Impact Scale. *Archives of Physical Medicine and Rehabilitation, 84,* 950-963.

Eccles, J. S., & Harold, R. D. (1993). Parent-school involvement during the early adolescent years. *Teachers College Record, 94*, 555-587.

Embretson, S. E. (1991). A multidimensional latent trait model for measuring learning and change. *Psychometrika, 56,* 495-515.

Englund, M. M., Luckner, A. E., Whaley, G. J. L., & Egeland, B. (2004). Children's achievement in early elementary school: Longitudinal effects of parent involvement, aspirations, and quality of assistance. *Journal of Educational Psychology, 96,* 723-730.

Epstein, D. J. (2007). The impact of parents' demographic and psychological characteristics and parent involvement on young children's reading and math outcomes. *Unpublished dissertation,* University of Maryland, College Park, ML.

Epstein, J. L. (1987). Parent involvement: What research says to administrators. *Education Urban Society, 19,* 119-136.

Epstein, J. L. (1991). Effects on student achievement of teachers' practices of parent involvement. In S. Silvern (Ed.), *Advances in reading/language research: Vol. 5. Literacy through family, community and school interaction* (pp. 261-276). Greenwich, CT: JAI.

Epstein, J. L. (1995). School/family/community partnerships: Caring for the children we share. *Phi Delta Kappan, 76,* 701-712.

Epstein, J. L. (2001). *School, family and community partnerships: Preparing educators and improving schooling.* Boulder, CO: Westview.

Epstein, J. L., Simon, B. S., & Salinas, K. C. (1997, September). *Involving parents in homework in the middle grades* (Research Bulletin No. 18). Bloomington, IN: Phi Delta Kappa /CEDR.

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

Fantuzzo, J., Tighe, E., & Childs, S. (2000). Family involvement questionnaire: A multivariate assessment of family participation in early childhood education. *Journal of Educational Psychology, 92,* 367-376.

Feuerstein, A. (2001). School characteristics and parent involvement: Influences on participation in children's schools. *The Journal of Educational Research, 94,* 29-40.

Ford, D. L. (1989). *Parental participation and academic achievement.* (ERIC Document Reproduction Service No. ED 344-659).

Fiese, B. H., & Schwartz, M. (2008). Reclaiming the family table: Mealtimes and child health and wellbeing. *Social Policy Report, 10,* 3-18.

Fulkerson, J. A., Neumark-Sztainer, D., & Story, M. (2006). Adolescent and parent views of family meals. *Journal of the American Dietetic Association, 106,* 526-532.

Gal, I., & Stoudt, A. (1995, September). Family achievement in mathematics. *NCAL Connections,* 9-10.

Glas, C. A. W. (2005). Book Review [Review of the book Explanatory Item Response models: A Generalized Linear and Non-linear Approach]. *Journal of Educational Measurement, 42(3),* 303-307.

Goldenberg, C., Gallimore, R., Reese, L., & Garnier, H. (2001). Cause or effect? A longitudinal study of immigrant Latino parents' aspirations and aspirations, and their children's school performance. *American Educational Research Journal, 38,* 547-584.

Graaf, N. D. D., Graaf, P. M. D., & Kraaykamp, G. (2000). Parental cultural capital and educational attainment in the Netherlands: A refinement of the cultural capital perspective. *Sociology of Education, 73,* 92-111.

Grolnick, W. S., & Slowiaczek, M. L. (1994). Parents' involvement in children's schooling: a multidimensional conceptualization and motivation model. *Child Development, 65,* 237-252.

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,* 538-548.

Grolck, W. S., Ryan, R. M., & Deci, E. L. (1991). The inner resources for school achievement: Motivational mediators of children's perceptions of their parents. *Journal of Educational Pscyhology, 83,* 508-517.

Goyette, K., & Xie, Y. (1999). Educational expectations of Asian American Youths: Determinants and ethnic differences. *Sociology of Education, 72,* 22-36.

Hahs-Vaughn, D. L. (2005). A primer for using and understanding weights with national dataset. *The Journal of Experimental Education, 73,* 221-248.

Hambleton, R. K., & Swaminathan, H. (1985). Item response theory. Boston: Kluwer-Nijhoff.

Hambleton, R. K., & Swaminathan, H., & Rogers, H. J. (1991). *Fundamentals of Item Response Theory*. Newburg Part, CA: Sage.

Hamilton, L., Cheng, S., & Powell, B. (2007). Adoptive parents, adaptive parents: Evaluating the importance of biological ties for parental investment. *American Sociological Review, 72,* 95-116.

Harwell, M. R., & Gatti, G. G. (2001). Rescaling ordinal data into interval data in educational research. *Review of Educational Research*, 71, 105-131.

Hill, N.E., & Taylor, L.C. (2004). Parental school involvement and children's academic achievement, pragmatics and issues. *Current directions in psychological science, 13,* 161 – 164.

Ho, S. E., & Willms, J. D. (1996). Effects of parent involvement on eighth-grade achievement. *Sociology of Education, 69,* 126-141.

Hoffer, T. B., & Shagle, S. (2003). *Social capital and elementary students' outcomes.* Paper presented at the annual meeting of American Sociological Association,

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

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

Hoover-Dempsey, K. V., Battiato, A. C., Walker, J. M. T., Reed, R. P., DeJong, J. M., & Jones, K. P. (2001). Parental involvement in homework. *Educational Psychologist, 36,* 195-210.

Hoover-Dempsey, K. V., 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. *The Elementary School Journal*, *106,* 105-130.

Horn, J. L., & McArdle, J. J. (1992). A practical and theoretical guide to measurement invariance in aging research. *Experimental Aging Research, 18,* 117-144.

Hu, L. –T., & Bentler, P. M. (1998). Fit Indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods, 3,* 424-453.

Hu, L. –T., & Bentler, P. M. (1999). Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.

Izzo, C. V., Weissberg, R. P., Kasprow, W. J., & Fendrich, M. (1999). A longitudinal assessment of teacher perceptions of parent involvement in children's education and school performance. *American Journal Community Psychology*, *27,* 817-839.

Kang, T., & Cohen, A. S. (2007). IRT model selection methods for dichotomous items. *Applied Psychological Measurement, 31*, 331-358.

Kerlinger, F. N. (1979). Behavioral research: A concept research. New York: Holt, Rinehart, and Winston.

Kim, E. (2002). The relationship between parental involvement and children's educational achievement in the Korean immigrant family. *Journal of Comparative Family Studies, 33,* 529-563.

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

Kingston, N. M., & McKinley, R. L. (1988). Assessing the structure of the GRE General Test using confirmatory multidimensional item response. Paper presented at the Annual meeting of the American Educational Research Association, New Orleans, LA, April 5-9.

Kohl, G., Lengua, L. J., & McMahon, R. (2000). Parent involvement in school: Conceptualizing multiple dimensions and their relations with family and demographic risk factors, *Journal of School Psychology, 38*, 501-523.

Lareau, A. (1987). Social class differences in family-school relationships: The importance of cultural capital. *Sociology of Education, 60,* 73-85.

Larson, R. (2008). Family mealtimes as a developmental context. *Social Policy Report, 10*, 12.

Lawson, M. A. (2003). School-family relations in context: Parent and teacher perceptions of parent involvement. *Urban Education, 38,* 1, 77-133.

Lemke, M., and Gonzales, P. (2006). *U.S. student and adult performance on International Assessments of Educational Achievement: Findings from the Condition of Education 2006* (NCES 2006-073). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Lemke, M., Sen, A., Pahlke, E., Partelow, L., Miller, D., Williams, T., Kastberg, D., and Jocelyn, L. (2004*). International Outcomes of Learning in Mathematics Literacy and Problem Solving: PISA 2003 Results From the U. S. Perspective* (NCES 2005-003). U. S. Department of Education, Washington, DC: National Center for Education Statistics.

Lightfoot, S. L. (1978). *Worlds Apart.* New York: Basic Books.

Lin, Q. (2003). Parent involvement and early literacy. http://www.gse.harard.edu/hfrp/projects/fine/resources/digest/literacy.html

Linacre, J. M. (2007). *A user's guide to Winsteps ministep: Rasch-model computer programs.* Chicago, IL:Winsteps.com.

Love, J. M., Meckstroth, A., & Sprachman, S. (1997). Measuring the quality of program environments in Head Start and other early childhood programs: A review and recommendations for future research.

McDonald, R. P. (1982). Linear versus nonlinear models in latent trait theory. *Applied Psychological Measurement, 6*, 379-396.

McGrath D. J., & Kuriloff P. J. (1999). "They are going to tear the doors off this place": Upper-Middle-class parent involvement and the educational opportunities of other people's children. *Educational Policy, 13,* 603-629.

McNeal, R. B. (1999). Parental involvement as social capital: Differential effectiveness on science achievement, truancy, and dropping out. *Social Forces, 78,* 117-144.

McWayne, C., Hampton, V., Fantuzzo, J., Cohen, H. L., & Sekino, Y. (2004). A multivariate examination of parent involvement and the social and academic competencies of urban kindergarten children. *Psychology in the Schools, 41(3),* 363-377.

Milne, A. M., Myers, D. E., Rosenthal, A. S., Ginsburg, A. (1986). Single parents, working mothers, and the educational achievement of school children. *Sociology of Education, 59,* 125-139.

Miller, G., Zhang, D., Ani, L., & Chen, H. (2009). Assessing parent involvement: A content analysis of current measures. Paper presented at the Annual meeting of National Association of School Psychology, Boston, MA February 24.

Muller, C. (1995). Maternal employment, parent involvement, and mathematics achievement among adolescents. *Journal of Marriage & the Family, 57,* 12-23.

Muthén, B. O. (1984). A general structural equation model with dichotomous, ordered categorical, and continuous latent variable indicators. *Psychometrika, 49,* 115-132.

Muthén, B. O. (1993). Goodness of fit with categorical and other non-normal variables. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 205-234). Newbury Park, CA: Sage.

Muthén, L. K., & Muthén, B. O. (1998-2007). Mplus user's guide. Fourth Edition. Los Angeles, CA: Muthén & Muthén.

National Center for Educational Statistics. (2001). *ECLS-K Base Year Public-Use User's Manual.* (NCES 2001-029).

National Center for Educational Statistics. (2006-86). School and Parent Interaction by Household Language and Poverty Status: 2002–03. Washington, DC:

Ng, F. F., Kenney-Benson, G. A., & Pomerantz, E. M. (2004). Children's Achievement Moderates the Effects of Mothers' Use of Control and Autonomy Support. *Child Development, 75,* 764-780.

Nord, C. W., & West, J. (2001). Fathers' and mothers' involvement in their children's school by family type and resident status. *Education Statistics Quarterly, 3*(2).

Organization for Economic Cooperation and Development (OECD). (2004). *Learning from tomorrow's world: First result from PISA 2003.* Paris: Author.

Overstreet, S., Devine, J., Bevans, K., & Efreom, Y. (2005). Predicting parental involvement in children's schooling within an economically disadvantaged African American sample. *Psychology in the Schools, 42,* 101 – 111.

Park, H. S; & Bauer, S. (2002) Parenting practices, ethnicity, SES, and academic achievement in adolescents. *School Psychology International, 23(4),* 386-396.

Reckase, M. D. (1985). The difficulty of test items that measure more than one ability. *Applied Psychological Measurement, 9,* 401-412.

Reckase, M. D. (1997). The past and future of multidimensional item response theory. *Applied Psychological Measurement, 21*, 25-36.

Reynolds, A. J. (1992). Comparing measures of parental involvement and their effects on academic achievement. *Early Childhood Research Quarterly, 7,* 441-462.

Rigdon, E. E., & Ferguson, C. E. (1991). The performance of the polychoric correlation coefficient and selected fitting functions in confirmatory factor analysis with ordinal data. *Journal of Marketing Research, 28,* 491-497.

Sarason, S. B. (1971). *The culture of the school and the problem of change.* Boston: Allyn and Bacon.

Shelton, S. B., & Epstein, J. L. (2005). Involvement counts: Family and community partnerships and mathematics achievement. *The Journal of Educational Research, 98,* 196-206.

Shumow, L., & Miller, J. D. (2001). Parents' at-home and at-school academic involvement with young adolescents. *Journal of Early Adolescence, 21,* 68-91.

Singh, K., Bickley, P. G., Trivette, P., Keith, T. Z., Keith, P. B., & Anderson, E. (1995). The effects of four components of parental involvement on eighth-grade student achievement: Structural analysis of NELS-88 data. *School Psychology Review, 24,* 299-317.

Sue, S., & Okazaki, S. (1990). Asian-American educational achievements: A phenomenon in search of an explanation. *American Psychologist, 45,* 913-920.

Sy, S. R., Rowley, S. J., & Schulenberg, J. E. (2007). Predictors of parent involvement across contests in Asian American and European American families. *Journal of Comparative Family Studies, 38,* 1-29.

Sy, S. R., & Schulenberg, J. E. (2005). Parent beliefs and children's achievement trajectories during the transition to school in Asian American and European American families. *International Journal of Behavioral Development, 29*, 505-515.

Thompson, B., & Daniel, L. G. (1996). Factor analytic evidence for the construct validity of scores: A historical overview and some guidelines. E*ducational and Psychological Measurement, 56,* 197-208.

Trivette, P., & Anderson, E. (1995).The effect of four components of parental involvement on eighth grade student achievement: structural analysis of NELS-88 data. *School Psychology Review, 24 (2),* 299-317.

Trusty, J. (2000). High educational expectations and low achievement: Stability of educational goals across adolescence. *Journal of Educational Research, 93,* 356-366.

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

Wang, W. (1998). Rasch analysis of distractors in multiple-choice items. *Journal of Outcome Measurement, 2*, 43-65.

Wilson, M. (2005). *Constructing Measures: An Item Response Modeling Approach.* Mahwah, New Jersey: Lawrence Erlbaum Associates.

Wong, S. W., & Hughes, J. N. (2006). Ethnicity and language contributions to dimensions of parent involvement. *School Psychology Review, 35,* 645-662.

Wu, F., & Qi, S. (2005). Parenting within cultural context: Comparisons between African-American and Asian-American parents. Paper presented at the annual conference of American Educational Research Association, Montreal, Canada, April 2005.

Wu, M. L., & Adams, R. J. (2006). Modelling mathematics problem solving item responses using a multidimensional IRT model. *Mathematics Education Research Journal, 18,* 93-113.

Wu, M. L., Adams, R. J., Wilson, M. R., & Haldane, S. A. (2007). *ACER ConQuest Version 2.0: Generalised Item Response Modeling Software.* Melbourne, Australia: Australian Council for Educational Research.

Wright, J. P., & Beaver, K. M. (2005). Do parents matter in creating self-control in their children? A genetically informed test of Gottfreson and Hirschi's theory of low self-control. *Criminology, 43,* 1169-1202.

Yan, W., & Lin, Q. (2005). Parent involvement and mathematics achievement: contrast across racial and ethnic groups. *Journal of Educational Research, 99,* 116-127.

Appendix A: The Information Sheet

Dear Dr. :

This is Hui-Fang (Lillian) Chen, a doctoral student in Quantitative Research Methods from University of Denver. I am currently working on my doctoral dissertation and Dr. Duan Zhang is my committee chair.

Thank you very much for being willing to serve on my expert panel on parent involvement (PI) and help with my dissertation. My topic is about longitudinal (k-5th grade) measurement of PI. I selected potential items on PI from the ECLS-K dataset and categorized these items into seven domains. Would you please review the items and my categorization to see if they make sense and if I left out any useful items that could be important to measure PI? Any comments or suggestions would be really helpful.

The definitions of the domains together with the items are attached. Please feel free to contact me (Hui-Fang.Chen@du.edu) or my chair (duan.zhang@du.edu) if you need more information or have any questions. Your time and help are greatly appreciated.

Best Regards,

Hui-Fang Chen

Appendix B: The Evaluation Table

This part is going to ask your opinions of categories and wording of items for assessing parent involvement from kindergarten to fifth grade. The total number of items is 25 and they were categorized into 7 domains as described previously. Please help me check if the category of each item is appropriate and give me some comments about each item or the whole set of items. Thank you so much!

Question	**Domains**	**Responses** 1: Very inappropriate 2. Inappropriate 3. Neither inappropriate nor appropriate 4. Appropriate 5. Very appropriate	**If the category is not appropriate, which domain will you suggest?**
How many children's books in your home now, including library books?	Home	1 2 3 4 5 Very inappropriate Very appropriate	
In the past month, has anyone in your family visited a library with child?	Home	1 2 3 4 5 Very inappropriate Very appropriate	
In a typical week, how often does child use this computer?	Home	1 2 3 4 5 Very inappropriate Very appropriate	
Outside of school hours, has child ever participated in dance lessons?	Home	1 2 3 4 5 Very inappropriate Very appropriate	
Outside of school hours, has child ever participated in organized athletic activities, like basketball,	Home	1 2 3 4 5 Very Very	

soccer, baseball, or gymnastics?		inappropriate appropriate	
Outside of school hours, has child ever participated in Organized clubs or recreational programs, like scouts?	Home	1 2 3 4 5 Very Very inappropriate appropriate	
Outside of school hours, has child ever participated in Music lessons, for example, piano, instrumental music or singing lessons?	Home	1 2 3 4 5 Very Very inappropriate appropriate	
Outside of school hours, has child ever participated in Art classes or lessons, for example, painting, drawing, sculpturing?	Home	1 2 3 4 5 Very Very inappropriate appropriate	
Outside of school hours, has child ever participated in Organized performing arts programs, such as children's choirs, dance programs, or theater performances?	Home	1 2 3 4 5 Very Very inappropriate appropriate	
During this school year, have you or another adult in your household taken it upon yourself to contact {CHILD}'s teacher or school for any reason having to do with {CHILD}?	Communication	1 2 3 4 5 Very Very inappropriate appropriate	
During this year, have you or another adult in your household gone to a regularly-scheduled parent-teacher conference with child's teacher or meeting	Communication	1 2 3 4 5 Very Very inappropriate appropriate	

with child's teacher?			
Have you met child's teacher yet?	Communication	1 2 3 4 5 Very inappropriate Very appropriate	
During this year, have you or another adult in your household Attended an open house or a back-to-school night?	School	1 2 3 4 5 Very inappropriate Very appropriate	
During this year, have you or another adult in your household Attended a meeting of a PTA, PTO, or parent-teacher student organization?	School	1 2 3 4 5 Very inappropriate Very appropriate	
During this year, have you or another adult in your household attended a school or class event, such as play, sports event, or science fair?	School	1 2 3 4 5 Very inappropriate Very appropriate	
During this year, have you or another adult in your household acted as a volunteer at the school or served on a committee?	School	1 2 3 4 5 Very inappropriate Very appropriate	
During this year, have you or another adult in your household participated in fundraising for child's school?	School	1 2 3 4 5 Very inappropriate Very appropriate	
About how many parents of children in child's or twin's class do you talk with regularly, either in person or on the phone?	Network	1 2 3 4 5 Very inappropriate Very appropriate	

This year, has the reason "The school does not make your family feel welcome" made it harder for you to participate in activities at child's school?	Relations between schools and parents	1 2 3 4 5 Very Very inappropriate appropriate	
How far in school do you expect {CHILD} to go?	Parental aspirations	1 2 3 4 5 Very Very inappropriate appropriate	
In a typical week, please tell me the number of days at least some of the family eats breakfast together?	Rules	1 2 3 4 5 Very Very inappropriate appropriate	
In a typical week, please tell me the number of days child has breakfast at a regular time?	Rules	1 2 3 4 5 Very Very inappropriate appropriate	
In a typical week, please tell me the number of days your family eats the evening meal together?	Rules	1 2 3 4 5 Very Very inappropriate appropriate	
In a typical week, please tell me the number of days the evening meal is served at a regular time?	Rules	1 2 3 4 5 Very Very inappropriate appropriate	
Does child usually go to bed at about the same time each night, or does his/her bedtime vary a lot from night to night?	Rules	1 2 3 4 5 Very Very inappropriate appropriate	

Your help is deeply appreciated. Thanks again.

Appendix C: Item Calibration: Items of the domain of School/home involvement at kindergarten wave

Item: P2COMPWK

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	1608425	48	-.17	-.13	.91	.92	NONE	(-.47)	0
1	1	797484	24	.89	.70	1.09	.84	-.51	.91	1
2	2	666798	20	1.32	1.27	1.02	1.06	-.36	2.06	2
3	3	284388	8	1.40	1.83	1.56	1.91	.87	(3.69)	3

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-.47)	-INF	.18		82%	57%		0
1	1.02	.00	.91	.18	1.47	.54	29%	55%	1.12	1
2	1.17	.00	2.06	1.47	2.91	1.39	42%	46%	.57	2
3	2.40	.00	(3.69)	2.91	+INF	2.64	48%	5%	.45	3

Item: BOOK

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	725688	22	-.76	-.72	.90	.91	NONE	(-1.60)	0
1	1	617692	18	.10	.09	.97	.96	-.78	-.25	1
2	2	787244	23	.68	.65	.97	.95	-.52	.64	2
3	3	662050	20	1.15	1.13	.97	.96	.41	1.55	3
4	4	564421	17	1.62	1.64	1.07	1.06	.89	(2.96)	4

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-1.60)	-INF	-.94		76%	43%		0
1	-.12	.00	-.25	-.94	.22	-.59	32%	36%	1.12	1
2	.14	.00	.64	.22	1.05	.23	34%	51%	1.09	2
3	1.07	.00	1.55	1.05	2.28	1.03	35%	49%	1.01	3
4	1.54	.00	(2.96)	2.28	+INF	1.94	73%	15%	.92	4

Item: Parent

```
-------------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT||STRUCTURE|CATEGORY|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ||CALIBRATN| MEASURE|
|-------------------+------------+------------++---------+--------|
|  0   0 1294371  39|  -.20  -.25|  1.06  1.02||  NONE   |(  -.92)| 0
|  1   1  995641  30|   .61   .64|  1.02  1.15||    -.21 |    .70 | 1
|  2   2 1067083  32|  1.28  1.32|  1.10  1.19||     .21 |(  2.33)| 2
-------------------------------------------------------------------
```

```
---------------------------------------------------------------------------
|CATEGORY    STRUCTURE   |  SCORE-TO-MEASURE   | 50% CUM.| COHERENCE|ESTIM|
| LABEL    MEASURE  S.E. | AT CAT. ----ZONE----|PROBABLTY| M->C C->M|DISCR|
|------------------------+---------------------+---------+----------+-----|
|   0      NONE          |(  -.92) -INF    -.20|         |  71%  47%|     | 0
|   1          .49    .00 |    .70   -.20   1.60|     .12 |  35%  72%|  .82| 1
|   2          .92    .00 |(  2.33)  1.60  +INF |    1.29 |  75%  34%|  .87| 2
---------------------------------------------------------------------------
```

Item: P1MTEACH

```
----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0   88679   3|  -.92 -1.05|  1.03   .97|   0%   0%|     | 0
|  1   1 3268416  97|   .55   .55|  1.08  1.03|  97% 100%|  .99| 1
----------------------------------------------------------------
```

Item: P2ATTENB

```
----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0  914797  27|  -.43  -.30|   .92   .85|  75%  34%|     | 0
|  1   1 2442298  73|   .87   .82|   .90   .89|  79%  95%| 1.14| 1
----------------------------------------------------------------
```

Item: P2ATTENP

```
----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 2239364  67|   .24   .19|  1.06  1.05|  73%  85%|     | 0
|  1   1 1117731  33|  1.05  1.16|  1.08  1.17|  57%  39%|  .82| 1
----------------------------------------------------------------
```

```
Item: P2PARGRP
-----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0  510242  15|  -.40  -.55|  1.06  1.18|  65%  14%|     | 0
|  1   1 2846853  85|   .67   .70|  1.07  1.04|  86%  98%|  .93| 1
-----------------------------------------------------------------
Item: P2ATTENS
-----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 1159005  35|  -.25  -.19|   .95   .93|  69%  50%|     | 0
|  1   1 2198090  65|   .91   .88|   .94   .91|  77%  87%| 1.11| 1
-----------------------------------------------------------------
Item: P2VOLUNT
-----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 1790934  53|  -.08   .05|   .85   .82|  78%  74%|     | 0
|  1   1 1566161  47|  1.19  1.04|   .85   .79|  72%  77%| 1.44| 1
Item: P2FUNDRS
-----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 1395453  42|  -.10  -.09|   .99   .98|  68%  54%|     | 0
|  1   1 1961642  58|   .95   .94|   .99   .99|  71%  82%| 1.02| 1
-----------------------------------------------------------------
Item: P2LIBRAR
 -----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 1588199  47|   .07  -.02|  1.08  1.09|  64%  56%|     | 0
|  1   1 1768896  53|   .91   .99|  1.10  1.17|  64%  72%|  .74| 1
-----------------------------------------------------------------
Item: P2ATHLET
ITEM DIFFICULTY MEASURE OF .81 ADDED TO MEASURES
-----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 1855169  55|   .00   .07|   .92   .91|  73%  78%|     | 0
|  1   1 1501926  45|  1.14  1.06|   .92   .87|  71%  64%| 1.24| 1
-----------------------------------------------------------------
```

Appendix D: Item Calibration: Items of the Domain of School/home Involvement at First-grade Wave

Item:P4COMPWK

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	1431628	37	-.08	-.02	.90	.92	NONE	(-.71)	0
1	1	1172767	31	1.06	.84	1.17	.95	-1.01	.90	1
2	2	926739	24	1.47	1.48	1.09	1.17	-.25	2.32	2
3	3	301204	8	1.52	2.10	1.72	1.91	1.26	(4.16)	3

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-.71)	-INF	.03		82%	44%		0
1	.64	.00	.90	.03	1.59	.33	35%	70%	1.21	1
2	1.40	.00	2.32	1.59	3.31	1.52	46%	35%	.44	2
3	2.91	.00	(4.16)	3.31	+INF	3.09	44%	7%	.50	3

Item: PARENT

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	1376303	36	-.02	-.05	1.02	.97	NONE	(-.78)	0
1	1	1089208	28	.83	.84	.99	1.01	-.15	.81	1
2	2	1366827	36	1.52	1.54	1.09	1.19	.15	(2.41)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-.78)	-INF	-.07		73%	41%		0
1	.66	.00	.81	-.07	1.69	.26	34%	73%	.90	1
2	.97	.00	(2.41)	1.69	+INF	1.37	76%	42%	.90	2

Item: BOOK

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	847259	22	-.48	-.49	.96	.94	NONE	(-1.23)	0
1	1	483479	13	.22	.27	.99	1.26	-.32	-.08	1
2	2	895730	23	.83	.80	1.00	.99	-.87	.71	2
3	3	840379	22	1.33	1.31	.99	1.00	.32	1.61	3
4	4	765491	20	1.82	1.85	1.13	1.10	.87	(3.07)	4

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-1.23)	-INF	-.67		78%	32%		0
1	.49	.00	-.08	-.67	.34	-.25	21%	44%	.95	1
2	-.07	.00	.71	.34	1.12	.29	35%	40%	1.03	2
3	1.12	.00	1.61	1.12	2.37	1.08	35%	54%	.95	3
4	1.67	.00	(3.07)	2.37	+INF	2.04	77%	20%	.87	4

Item: P4ATTENB

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	889226	23	-.31	-.12	.90	.78	79%	31%		0
1	1	2943112	77	1.10	1.04	.86	.87	82%	97%	1.16	1

Item: P4ATTENP

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	2267458	59	.43	.36	1.07	1.07	70%	73%		0
1	1	1564880	41	1.26	1.36	1.10	1.16	58%	55%	.76	1

Item: P4PARGRP

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	459931	12	-.24	-.40	1.06	1.14	62%	12%		0
1	1	3372407	88	.91	.93	1.09	1.05	89%	99%	.95	1

Item: P4ATTENS

```
-------------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0    0 1061405  28|  -.15  -.04|   .94   .85|  70%  36%|     | 0
|  1    1 2770933  72|  1.12  1.08|   .92   .91|  79%  94%| 1.12| 1
-------------------------------------------------------------------
```

Item: P4VOLUNT

```
-------------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0    0 2032238  53|   .13   .30|   .81   .75|  79%  78%|     | 0
|  1    1 1800100  47|  1.49  1.31|   .82   .75|  75%  77%| 1.56| 1
-------------------------------------------------------------------
```

Item: P4FUNDRS

```
-------------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0    0 1345457  35|   .06   .07|   .98   .95|  69%  40%|     | 0
|  1    1 2486881  65|  1.16  1.15|  1.00  1.03|  73%  90%| 1.03| 1
-------------------------------------------------------------------
```

Item: P4MTEACH

```
-------------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0    0   48252   1| -1.14 -1.07|   .97  1.11|   0%   0%|     | 0
|  1    1 3784086  99|   .79   .79|   .91   .98|  98% 100%| 1.01| 1
-------------------------------------------------------------------
```

Item: P4LIBRAR

```
-------------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0    0 2093408  55|   .40   .31|  1.10  1.11|  65%  73%|     | 0
|  1    1 1738930  45|  1.21  1.32|  1.11  1.23|  62%  52%|  .69| 1
-------------------------------------------------------------------
```

Item: P4ATHLET

```
 -------------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0    0 1778085  46|   .14   .22|   .91   .88|  72%  67%|     | 0
|  1    1 2054253  54|  1.32  1.25|   .92   .92|  73%  77%| 1.23| 1
-------------------------------------------------------------------
```

Appendix E: Item Calibration: Items of the Domain of School/home Involvement at Third-grade Wave

Item: P5COMPWK

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	850198	26	-.06	-.04	.97	.97	NONE	(-1.14)	0
1	1	1067041	32	.98	.79	1.29	1.23	-1.15	.56	1
2	2	999664	30	1.38	1.40	1.14	1.21	-.16	2.04	2
3	3	387419	12	1.55	1.97	1.56	1.64	1.30	(3.88)	3

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-1.14)	-INF	-.36		76%	32%		0
1	.18	.00	.56	-.36	1.28	-.09	35%	57%	1.05	1
2	1.17	.00	2.04	1.28	3.04	1.24	44%	52%	.36	2
3	2.63	.00	(3.88)	3.04	+INF	2.82	58%	4%	.52	3

Item: BOOK

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	756608	23	-.18	-.17	.98	.97	NONE	(-1.16)	0
1	1	707599	21	.61	.60	.97	.94	-1.02	.26	1
2	2	991663	30	1.19	1.15	1.02	1.09	-.77	1.30	2
3	3	541320	16	1.61	1.63	1.08	1.12	.67	2.38	3
4	4	307132	9	2.05	2.13	1.14	1.14	1.12	(3.87)	4

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-1.16)	-INF	-.49		75%	35%		0
1	.31	.00	.26	-.49	.80	-.14	32%	45%	1.02	1
2	.55	.00	1.30	.80	1.82	.75	40%	59%	.99	2
3	2.00	.00	2.38	1.82	3.17	1.85	34%	30%	.89	3
4	2.44	.00	(3.87)	3.17	+INF	2.84	68%	6%	.84	4

Item: PARENT3

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	1125055	34	.12	.17	.93	.92	NONE	(-.81)	0
1	1	1343849	41	1.03	1.03	.93	.91	-.70	1.14	1
2	2	835418	25	1.74	1.69	.96	.98	.70	(3.09)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-.81)	-INF	.04		76%	37%		0
1	.45	.00	1.14	.04	2.24	.26	46%	86%	1.12	1
2	1.84	.00	(3.09)	2.24	+INF	2.02	75%	23%	1.11	2

Item: P5ATTENB

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	594429	18	-.22	.00	.90	.73	73%	25%		0
1	1	2709893	82	1.15	1.10	.87	.89	85%	97%	1.12	1

Item: P5ATTENP

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	1876816	57	.57	.51	1.05	1.05	68%	75%		0
1	1	1427506	43	1.34	1.41	1.08	1.14	63%	53%	.79	1

Item: P5PARGRP

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	307377	9	-.03	-.21	1.06	1.15	64%	8%		0
1	1	2996945	91	1.00	1.01	1.07	1.04	91%	99%	.95	1

Item: P5ATTENS

```
 ---------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0  729536  22|  -.11   .08|   .90   .79|  81%  23%|     | 0
|  1   1 2574786  78|  1.19  1.13|   .87   .88|  81%  98%| 1.14| 1
---------------------------------------------------------------
```

Item: P5VOLUNT

```
---------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 1774771  54|   .35   .48|   .84   .81|  78%  75%|     | 0
|  1   1 1529551  46|  1.54  1.39|   .85   .78|  72%  75%| 1.49| 1
---------------------------------------------------------------
```

Item: P5FUNDRS

```
---------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 1120942  34|   .17   .26|   .93   .87|  68%  48%|     | 0
|  1   1 2183380  66|  1.28  1.23|   .94   .97|  77%  88%| 1.14| 1
---------------------------------------------------------------
```

Item: P5MTEACH

```
 ---------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0   39500   1|  -.55  -.62|  1.02   .90|   0%   0%|     | 0
|  1   1 3264822  99|   .92   .92|  1.07  1.02|  98% 100%| 1.00| 1
---------------------------------------------------------------
```

Item: P5ATHLET

```
---------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 1422091  43|   .35   .37|   .98   .96|  70%  52%|     | 0
|  1   1 1882231  57|  1.31  1.30|   .99  1.01|  69%  83%| 1.04| 1
---------------------------------------------------------------
```

Item: P5LIBRAR

```
 ---------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 1517063  46|   .52   .40|  1.11  1.13|  61%  54%|     | 0
|  1   1 1787259  54|  1.22  1.33|  1.13  1.21|  64%  70%|  .64| 1
---------------------------------------------------------------
```

Appendix F: Item Calibration: Items of the domain of School/home Involvement at Fifth-wave

Item: P6COMPWK

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	796325	21	-.18	-.16	.98	.98	NONE	(-1.41)	0
1	1	1099544	29	.73	.59	1.25	1.21	-.91	.20	1
2	2	1147333	30	1.19	1.11	1.06	1.24	-.02	1.47	2
3	3	777984	20	1.36	1.65	1.45	1.46	.93	(3.09)	3

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-1.41)	-INF	-.66		81%	22%		0
1	-.07	.00	.20	-.66	.83	-.37	34%	51%	1.04	1
2	.81	.00	1.47	.83	2.33	.82	40%	60%	.50	2
3	1.76	.00	(3.09)	2.33	+INF	2.05	53%	14%	.21	3

Item: BOOK5

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	909353	24	-.19	-.21	1.02	1.00	NONE	(-.99)	0
1	1	536593	14	.43	.43	1.00	.95	-.21	.10	1
2	2	691692	18	.86	.85	1.14	1.18	-.49	.79	2
3	3	958759	25	1.27	1.25	.98	1.00	-.17	1.58	3
4	4	724789	19	1.67	1.73	1.13	1.10	.87	(3.08)	4

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-.99)	-INF	-.45		78%	33%		0
1	.67	.00	.10	-.45	.46	-.03	24%	33%	.94	1
2	.39	.00	.79	.46	1.13	.49	23%	39%	.93	2
3	.72	.00	1.58	1.13	2.33	1.00	38%	54%	.91	3
4	1.76	.00	(3.08)	2.33	+INF	2.04	66%	19%	.81	4

Item: PARENT

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	1691933	44	.23	.26	.92	.89	NONE	(-.39)	0
1	1	1134002	30	.97	.97	.93	1.09	-.17	1.21	1
2	2	995251	26	1.60	1.55	.95	1.00	.17	(2.82)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-.39)	-INF	.33		75%	50%		0
1	1.04	.00	1.21	.33	2.10	.65	35%	78%	1.11	1
2	1.39	.00	(2.82)	2.10	+INF	1.78	85%	18%	1.18	2

Item: P6ATTENB

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	781382	20	-.18	.04	.89	.78	80%	23%		0
1	1	3039804	80	1.06	1.00	.85	.87	83%	98%	1.15	1

Item: P6ATTENP

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	2308318	60	.51	.49	1.02	1.01	70%	81%		0
1	1	1512868	40	1.25	1.29	1.03	1.06	62%	46%	.91	1

Item: P6PARGRP

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	446805	12	-.08	-.15	1.02	1.06	65%	11%		0
1	1	3374381	88	.92	.93	1.04	1.01	89%	99%	.98	1

Item: P6ATTENS

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	947005	25	-.04	.12	.91	.80	71%	28%		0
1	1	2874181	75	1.09	1.03	.89	.89	80%	96%	1.15	1

Item: P6VOLUNT

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	2229015	58	.34	.47	.83	.81	73%	88%		0
1	1	1592171	42	1.45	1.27	.84	.76	78%	55%	1.53	1

Item: P6FUNDRS

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	1195940	31	.15	.20	.96	.94	69%	34%		0
1	1	2625246	69	1.10	1.08	.96	.99	75%	93%	1.08	1

Item: P6MTEACH

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	78481	2	-1.08	-.59	.93	.57	0%	0%		0
1	1	3742705	98	.85	.84	.79	.94	97%	100%	1.04	1

Item: P6LIBRAR

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	1937489	51	.56	.41	1.15	1.18	59%	57%		0
1	1	1883697	49	1.06	1.22	1.16	1.41	58%	60%	.41	1

Item: P6ATHLET

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR	
0	0	1484426	39	.29	.29	.99	.96	63%	48%		0
1	1	2336760	61	1.13	1.13	1.01	1.11	71%	82%	1.00	1

Appendix G: Item Calibration: Items of the Domain of Home Investment at Kindergarten wave

```
SUMMARY OF CATEGORY STRUCTURE.  Model="R"
----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 4238650  69| -1.18 -1.18|   .99   .99|  75%  93%|     | 0
|  1   1 1932075  31|  -.34  -.34|  1.00  1.02|  70%  32%| 1.00| 1
----------------------------------------------------------------
OBSERVED AVERAGE is mean of measures in category. It is not a parameter estimate.
        DICHOTOMOUS CURVES
P      -+-------------+-------------+-------------+-------------+-
R  1.0 +                                                           +
O      |                                                           |
B      |0                                                         1|
A      | 000000                                            111111 |
B   .8 +       00000                                  11111       +
I      |            0000                          1111            |
L      |                0000                  1111                |
I      |                    000            111                    |
T   .6 +                       000      111                       +
Y      |                          000   111                       |
    .5 +                             ***                          +
O      |                          111   000                       |
F   .4 +                       111      000                       +
       |                    111            000                    |
R      |                1111                  0000                |
E      |            1111                          0000            |
S   .2 +       11111                                  00000       +
P      | 111111                                            000000 |
O      |1                                                         0|
N      |                                                           |
S   .0 +                                                           +
E      -+-------------+-------------+-------------+-------------+-
       -2            -1             0             1             2
        PERSON [MINUS] ITEM MEASURE
```

Appendix H: Item Calibration: Items of the Domain of Home Investment at First-grade Wave

```
SUMMARY OF CATEGORY STRUCTURE.  Model="R"
----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 6346029  66| -1.21 -1.21|  1.02  1.07|  74%  91%|     | 0
|  1   1 3214566  34|  -.09  -.09|   .99   .97|  69%  37%| 1.00| 1
----------------------------------------------------------------
OBSERVED AVERAGE is mean of measures in category. It is not a parameter estimate.
```

```
        DICHOTOMOUS CURVES
P      -+-------------+-------------+-------------+-------------+-
R  1.0 +                                                         +
O      |                                                         |
B      |0                                                       1|
A      | 000000                                           111111 |
B   .8 +       00000                                 11111       +
I      |            0000                         1111            |
L      |                0000                 1111                |
I      |                    000           111                    |
T   .6 +                       000     111                       +
Y      |                          000 111                        |
    .5 +                             ***                         +
O      |                          111 000                        |
F   .4 +                       111     000                       +
       |                    111           000                    |
R      |                1111                 0000                |
E      |            1111                         0000            |
S   .2 +       11111                                 00000       +
P      | 111111                                           000000 |
O      |1                                                       0|
N      |                                                         |
S   .0 +                                                         +
E      -+-------------+-------------+-------------+-------------+-
       -2            -1             0             1             2
        PERSON [MINUS] ITEM MEASURE
```

Appendix I: Item Calibration: Items of the Domain of Home Investment at Third-grade Wave

```
SUMMARY OF CATEGORY STRUCTURE.  Model="R"

-------------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 6014534  66| -1.18 -1.18|  1.02  1.05|  73%  91%|     | 0
|  1   1 3083886  34|  -.09  -.09|   .99   .97|  68%  37%| 1.00| 1
-------------------------------------------------------------------
OBSERVED AVERAGE is mean of measures in category. It is not a parameter estimate.
        DICHOTOMOUS CURVES
P      -+-------------+-------------+-------------+-------------+-
R  1.0 +                                                         +
O      |                                                         |
B      |0                                                       1|
A      | 000000                                           111111 |
B   .8 +      00000                                    11111     +
I      |           0000                            1111          |
L      |               0000                    1111              |
I      |                   000              111                  |
T   .6 +                      000        111                     +
Y      |                         000   111                       |
    .5 +                            ***                          +
O      |                         111   000                       |
F   .4 +                      111         000                    +
       |                   111               000                 |
R      |               1111                     0000             |
E      |           1111                             0000         |
S   .2 +      11111                                     00000    +
P      | 111111                                           000000 |
O      |1                                                       0|
N      |                                                         |
S   .0 +                                                         +
E      -+-------------+-------------+-------------+-------------+-
       -2            -1             0             1             2
        PERSON [MINUS] ITEM MEASURE
```

Appendix J: Item Calibration: Items of the Domain of Home Investment at Fifth-grade Wave

```
SUMMARY OF CATEGORY STRUCTURE.  Model=”R”
----------------------------------------------------------------
|CATEGORY   OBSERVED|OBSVD SAMPLE|INFIT OUTFIT| COHERENCE|ESTIM|
|LABEL SCORE COUNT %|AVRGE EXPECT|  MNSQ  MNSQ| M->C C->M|DISCR|
|-------------------+------------+------------+----------+-----|
|  0   0 6857476  65| -1.14 -1.14|  1.01  1.02|  75%  85%|     | 0
|  1   1 3736224  35|  -.04  -.04|  1.00   .99|  64%  49%| 1.00| 1
----------------------------------------------------------------
OBSERVED AVERAGE is mean of measures in category. It is not a parameter estimate.
        DICHOTOMOUS CURVES
P      -+-------------+-------------+-------------+-------------+-
R  1.0 +                                                         +
O      |                                                         |
B      |0                                                       1|
A      | 000000                                           111111 |
B   .8 +       00000                                 11111       +
I      |            0000                         1111            |
L      |                0000                 1111                |
I      |                    000           111                    |
T   .6 +                       000     111                       +
Y      |                          000 111                        |
    .5 +                             ***                         +
O      |                          111 000                        |
F   .4 +                       111     000                       +
       |                    111           000                    |
R      |                1111                 0000                |
E      |            1111                         0000            |
S   .2 +       11111                                 00000       +
P      | 111111                                           000000 |
O      |1                                                       0|
N      |                                                         |
S   .0 +                                                         +
E      -+-------------+-------------+-------------+-------------+-
       -2            -1             0             1             2
        PERSON [MINUS] ITEM MEASURE
```

Appendix K: Item Calibration: Items of the domain of Family Routines at Kindergarten-wave

Item: P2BKREG

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	371867	15	-.04	-.66	1.48	1.45	NONE	(-2.64)	0
1	1	1325524	54	.21	.23	1.33	1.38	-1.33	-.17	1
2	2	773805	31	.70	.97	1.28	1.25	1.33	(2.31)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-2.64)	-INF	-1.66		14%	8%		0
1	-1.49	.00	-.17	-1.66	1.32	-1.56	47%	60%	.54	1
2	1.16	.00	(2.31)	1.32	+INF	1.22	40%	28%	.42	2

Item: P2EVENG2

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	622141	25	-.68	-.59	.94	.88	NONE	(-1.75)	0
1	1	737484	30	.17	.22	.77	.77	-.26	-.09	1
2	2	1111571	45	.98	.91	.85	.83	.26	(1.56)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-1.75)	-INF	-1.01		90%	33%		0
1	-.36	.00	-.09	-1.01	.82	-.71	37%	85%	1.24	1
2	.17	.00	(1.56)	.82	+INF	.52	85%	42%	1.26	2

Item: P2EVENG

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	686833	28	-.72	-.49	.74	.72	NONE	(-1.70)	0
1	1	1014240	41	.37	.35	.75	.68	-.72	.26	1
2	2	770123	31	1.19	1.02	.75	.75	.72	(2.23)	2

OBSERVED AVERAGE is mean of measures in category. It is not a parameter estimate.

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-1.70)	-INF	-.85		95%	31%		0
1	-.46	.00	.26	-.85	1.37	-.64	50%	85%	1.50	1
2	.98	.00	(2.23)	1.37	+INF	1.16	74%	53%	1.53	2

Appendix L: Item Calibration: Items of the Domain of Family Routines at First-grade Wave

Item: P4BKREG

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	412674	14	.01	-.79	1.58	1.55	NONE	(-2.84)	0
1	1	1716875	59	.19	.22	1.35	1.37	-1.60	-.12	1
2	2	762849	26	.70	1.05	1.32	1.31	1.60	(2.61)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-2.84)	-INF	-1.82		0%	0%		0
1	-1.71	.00	-.12	-1.82	1.59	-1.75	57%	76%	.49	1
2	1.48	.00	(2.61)	1.59	+INF	1.52	33%	26%	.47	2

Item: P4EVENG2

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	708235	24	-.87	-.74	.88	.84	NONE	(-1.85)	0
1	1	832027	29	.09	.16	.69	.67	-.26	-.19	1
2	2	1352136	47	1.04	.93	.77	.76	.26	(1.47)	2

OBSERVED AVERAGE is mean of measures in category. It is not a parameter estimate.

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-1.85)	-INF	-1.11		91%	40%		0
1	-.45	.00	-.19	-1.11	.73	-.80	51%	67%	1.33	1
2	.08	.00	(1.47)	.73	+INF	.42	76%	84%	1.36	2

Item: P4EVENG

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	844651	29	-.81	-.58	.74	.73	NONE	(-1.68)	0
1	1	1183371	41	.38	.35	.72	.63	-.75	.31	1
2	2	864376	30	1.27	1.08	.74	.74	.75	(2.30)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-1.68)	-INF	-.82		96%	35%		0
1	-.45	.00	.31	-.82	1.43	-.62	52%	87%	1.49	1
2	1.06	.00	(2.30)	1.43	+INF	1.23	76%	54%	1.52	2

Appendix M: Item Calibration: Items of the Domain of Family Routines at Third-grade Wave

Item: P5BKREG

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	396164	16	-.12	-.97	1.62	1.60	NONE	(-2.93)	0
1	1	1565556	62	.13	.15	1.44	1.43	-1.77	-.03	1
2	2	546907	22	.57	1.15	1.47	1.46	1.77	(2.86)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-2.93)	-INF	-1.88		0%	0%		0
1	-1.81	.00	-.03	-1.88	1.81	-1.83	58%	74%	.41	1
2	1.74	.00	(2.86)	1.81	+INF	1.76	23%	22%	.39	2

Item: P5EVENG2

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	601410	24	-1.15	-.96	.79	.78	NONE	(-2.09)	0
1	1	795810	32	-.08	.00	.62	.53	-.47	-.31	1
2	2	1111407	44	1.11	.95	.72	.73	.47	(1.48)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-2.09)	-INF	-1.30		88%	49%		0
1	-.78	.00	-.31	-1.30	.69	-1.04	56%	73%	1.43	1
2	.16	.00	(1.48)	.69	+INF	.42	80%	81%	1.48	2

Item: P5EVENG

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	846653	34	-.95	-.74	.74	.73	NONE	(-1.60)	0
1	1	946774	38	.28	.29	.67	.55	-.69	.34	1
2	2	715200	29	1.41	1.16	.65	.65	.69	(2.29)	2

CATEGORY	STRUCTURE		SCORE-TO-MEASURE			50% CUM.	COHERENCE		ESTIM	
LABEL	MEASURE	S.E.	AT CAT.	----ZONE----		PROBABLTY	M->C	C->M	DISCR	
0	NONE		(-1.60)	-INF	-.75		78%	73%		0
1	-.34	.00	.34	-.75	1.44	-.53	57%	73%	1.51	1
2	1.03	.00	(2.29)	1.44	+INF	1.22	82%	60%	1.63	2

Appendix N: Item Calibration: Items of the Domain of Family Routines at Fifth-grade Wave

Item: P6BKREG

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	482131	15	-.36	-1.07	1.51	1.49	NONE	(-3.07)	0
1	1	1958992	62	.02	.04	1.38	1.38	-1.80	-.15	1
2	2	694911	22	.67	1.11	1.34	1.34	1.80	(2.76)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-3.07)	-INF	-2.02		0%	0%		0
1	-1.95	.00	-.15	-2.02	1.72	-1.97	60%	77%	.52	1
2	1.65	.00	(2.76)	1.72	+INF	1.67	28%	24%	.54	2

Item: P6EVENG2

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	867589	28	-1.15	-.99	.83	.81	NONE	(-1.98)	0
1	1	975459	31	-.08	-.03	.62	.53	-.42	-.23	1
2	2	1292986	41	1.09	.94	.76	.75	.42	(1.53)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-1.98)	-INF	-1.20		91%	50%		0
1	-.64	.00	-.23	-1.20	.75	-.93	53%	74%	1.40	1
2	.19	.00	(1.53)	.75	+INF	.47	79%	79%	1.44	2

Item: P6EVENG

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	STRUCTURE CALIBRATN	CATEGORY MEASURE	
0	0	1096133	35	-.96	-.81	.82	.81	NONE	(-1.65)	0
1	1	1243832	40	.24	.24	.77	.70	-.80	.38	1
2	2	796069	25	1.36	1.16	.75	.73	.80	(2.40)	2

CATEGORY LABEL	STRUCTURE MEASURE	S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		50% CUM. PROBABLTY	COHERENCE M->C	C->M	ESTIM DISCR	
0	NONE		(-1.65)	-INF	-.78		74%	73%		0
1	-.42	.00	.38	-.78	1.53	-.58	58%	67%	1.35	1
2	1.17	.00	(2.40)	1.53	+INF	1.33	77%	58%	1.42	2