Spring 5-18-2019

The Impact of the Discrepancies Between Student and Parent Expectations on Academic Achievement: An Ecological Approach

Thom Suhy
Southern Methodist University, tsuhy@smu.edu

The Impact of the Discrepancies Between Student and Parent Expectations on Academic Achievement: An Ecological Approach

Thom M. Suhy

Southern Methodist University

April 24, 2019

Table of Contents

“Witness the American ideal: The Self-Made Man. But there is no such person. If we can stand on our own two feet, it is because others have raised us up. If, as adults, we can lay claim to competence and compassion, it only means that other human beings have been willing and enabled to commit their competence and compassion to us--through infancy, childhood, and adolescence, right up to this very moment." - Urie Bronfenbrenner 1977

Dedication

This dissertation – almost 7 years of blood, sweat, and tears – is dedicated to my family that has stuck by me throughout the entire process and my late friend Bob. We miss you Bobby!

Mom, you have been behind me from day one. Your unconditional love and ability to provide Nun-like guilt on demand has pushed me through some of the toughest times. Thank you for being there, no-matter what.

Dylan and Camden, a lot has transpired through the writing of this paper, but a few things have not changed. One, I love you unconditionally, and you mean more to me than anything. Two, I have always been proud of your accomplishments and grow prouder every day. Three, I continue to be amazed at the men you are becoming.

Lisa, the love of my life, I would not be here if it weren’t for you. Unlike my mom, you did not use guilt, but actual tough love to get me through. I appreciate your undying love for me, your consistent support, and the fact that you did not let me give up, on anything. I love you.

Acknowledgements

I would like to thank the members of my cohort for their support and love during this long process. In particular, Dr. Elizabeth Howell has been a lighthouse in the storm. My Ignite family has been so supportive over the last 3 years. Thank you to Julie Hamrick and Barbie Boe for putting up with me during this time, I will be forever grateful. Dr. Paige Ware was one of the first people to introduce me to Bronfenbrenner. Without her direction, this paper would not have been possible. Dr. Paul Yovanoff has been an amazing supporter through the entire process. Always being honest, but with a kind touch. Dr. Aki Kamata was always there to direct me and my statistical model, at time showing amazing patience. Finally, Dr. Ken Springer has been a tremendous adviser, mentor, and friend throughout. Thank you for your “tough love”.

Chapter 1: Introduction

For decades, parents, teachers, administrators, and policy-makers have struggled to find effective ways to bridge the achievement gap that exists between students in America's inner-city schools and those in schools that serve mostly middle- and upper-class students. While multiple roadblocks and barriers must be navigated when attempting to address this issue, time and money appear to be the biggest obstacles to reducing the growing gap of achievement levels between these two very diverse populations. The barrier of time is created not by the lack of time per se, but by the impatience of parents and educators who call for immediate results. Parents press schools for better academic results for their children, but do not want their children to be participants in an experiment, testing out cutting edge programs that have not yet been fully researched. At the same time, teachers and school administrators are pressed by district and state accountability standards to find immediate solutions to reduce the number of unacceptable test scores. Seemingly, the end result is the adoption of programs that appear to be effective in certain environments, but these programs may not mirror the campus environment where the new implementation takes place.

Similarly, district funds are not always available in low-income schools to implement a successful program to its fullest capacity. Areas such as teacher training and classroom materials may be foregone so that campuses may implement as much of the new program, to as many students within the district, as possible. As this constant circle of ineffectiveness continues to haunt the low-income, mostly minority students of inner-city schools, many are searching for a way to close the achievement gap in the absence of time or money, or both. Perhaps one viable solution to this apparently never-ending issue is the implementation of effective parent engagement practices within these struggling campuses.

Parent engagement (also known as parent involvement) appears to be a simple solution to addressing the achievement gap problem, but it is far from simple. Previous researchers, such as Epstein, Jeynes, and Fan and Chen, have defined parent engagement as the involvement of parents in the academic life of their children – both at home (i.e. setting up a specific time for homework, parents reading to kids, parents assisting with homework) and at school (i.e. attending parent teacher conferences, parents assisting teachers in their classrooms, parents working fundraisers for the school) (Epstein, 1988a, 1988b; Fan & Chen, 2001; Jeynes, 2003, 2005, 2007). For years, researchers have evaluated some form of the characterizations above in order to appraise the power of such participation on the educational attainment of students. It is the variation in the definitions of parent engagement, though, that has led to conflicting findings on the impact of parent involvement on academic achievement. Experts such as Epstein (1988a, 1988b), Fan and Chen (2001), and Jeynes (2003, 2005, 2007) have attempted to give a stronger construct to the definition of parent involvement with some success. Today, nevertheless, studies continue to be implemented that loosely define parent engagement, making it difficult to interpret and replicate results.

The following review of literature investigates the history of research on parent involvement in relation to students' academic achievement. In addition, this review examines Bronfenbrenner's theory of ecological systems (1979, 1986, 1992, 2005) as the conceptual framework through which the success of parent engagement practices can be evaluated. While this review intends to give a historical perspective of studies on parent engagement, it is by no means a comprehensive review of all parent engagement research. Care was taken to examine the most cited, or widely accepted, studies on parent engagement within each section of this paper. These sections were carefully chosen to represent research on parent engagement prior to the work of Fan and Chen (2001), the time between 2001 and 2007 when Fan and Chen (2001) and Jeynes (2003,2005, 2007) published meta-analyses on parent engagement, and studies publish in the era immediately following the publication of Fan and Chen's meta-analysis.

As touched on previously, the remainder of this paper will chronicle the history of research on parent engagement in relation to student attainment through the separation of information into four sections. The first section reviews Bronfenbrenner's theory of ecological systems (1979, 1986, 1992, 2005), and why this theory serves as the foundational framework when evaluating effectiveness of parent involvement programs. The second section examines parent involvement research conducted during an era stretching from the early 1980s to 2000 (e.g., Epstein, 1988a, 1988b; Griffith, 1996, 1997, 1998; Marcon, 1993a, 1993b) in an effort to illustrate the discourse within the field and the confusion these results initiated, and to identify the potential cause of the conflicting outcomes. The third section considers in depth the meta-analyses of Fan and Chen (2001) and Jeynes (2003, 2005, 2007) and the importance that all four of these studies have within the field of parent engagement research, in particular the clarity provided in defining impactful parent involvement practices and the variables these practices transform. The last section of this review of literature examines research conducted from 2002 through 2015 that specifically addresses the impact of parent expectations on student academic outcomes. This specific area of concentration was chosen in part because of the findings of Fan and Chen (2001) and Jeynes (2003, 2005, 2007), which will be discussed within this review.

Chapter 2: Literature Review

Bronfenbrenner's Theory of Ecological Systems

Parent engagement, whether through direct interactions with a child, or indirectly through parent interfaces with the child's school and community, should be considered a series of critical relationships impacting student academic achievement. It is, therefore, remiss to report on the success and failures of parent involvement practices without understanding the social context in which the children, and their parents, have been raised, and where these practices take place. Bronfenbrenner (1979, 1986, 1992, 2005) examined the differing systems in which humans – more precisely children, their parents, their teachers, and their administrators – develop in order to gain a greater understanding of the social contexts and connections that are critical to human development. This theory of ecological systems established by Bronfenbrenner – sometimes referred to as the bioecological systems theory – will provide the conceptual framework in which this review of literature on parent involvement practices is grounded. As such, the remainder of this section will examine the five ecological systems of human development presented by Bronfenbrenner – the microsystem, the exosystem, the mesosystem, the macrosystem, and the chronosystem – and show how social contexts within each system contribute to both the participation in and the effectiveness of the varying dimensions of parent engagement.

The ecological system, as mentioned previously, consists of five systems (see figure 1) – the microsystem, the exosystem, the mesosystem, the macrosystem, and the chronosystem – of interrelations that influence, both directly and indirectly, the unique development of each individual person (Bronfenbrenner, 1979, 1986, 1992, 2005). Bronfenbrenner defined these interrelations, or molar activities, as "an ongoing behavior possessing a momentum of its own and perceived as having meaning or intent by the participants in the setting" (1979, p. 45). The most influential molar activities are generally not singular or fleeting in nature; instead the most instrumental interactions are those that take the form of lasting engagements, repeated over time.

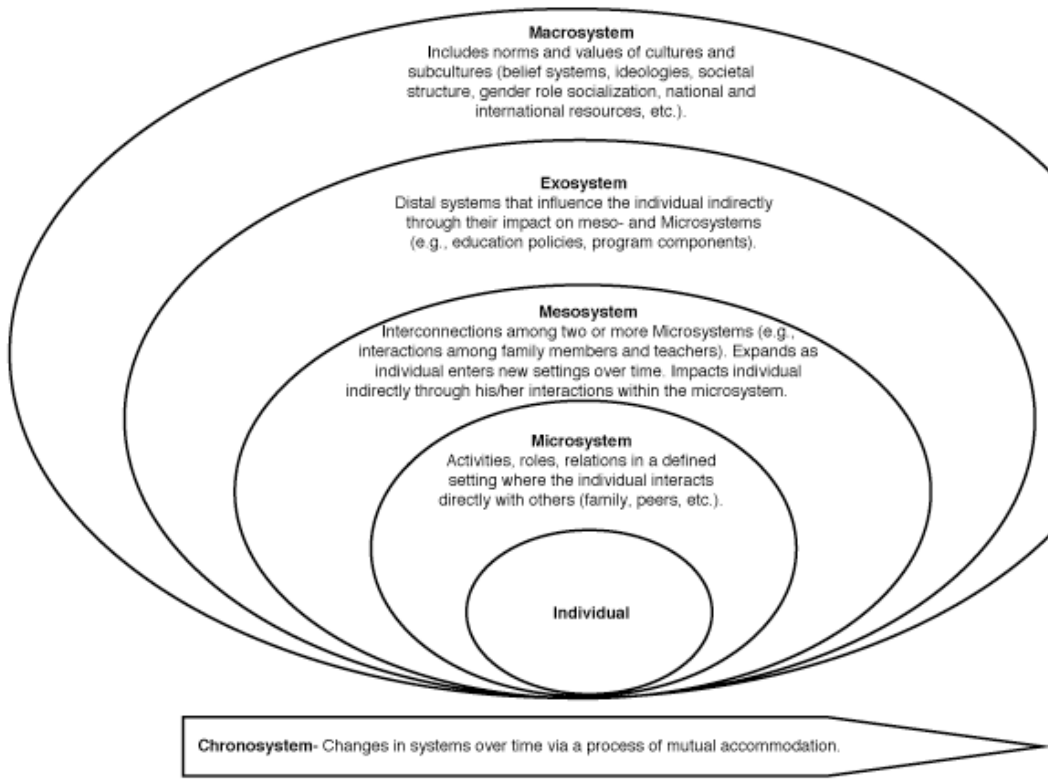


Figure 1. Bronfenbrenner's theory of ecological development

(Source: Diagram of Bronfenbrenner's ecological system, n.d.)

Molar activities create dyads, or a two-person system, which is created when "two people interact or pay attention to each other" (Bronfenbrenner, 1979, p. 45). Dyadic systems may be observational in nature, where one person develops through watching the other, or they may occur in a joint activity dyad where both members of the dyad are active participants in the activity. While reciprocal in nature, joint activity dyads do not necessarily split the power of the activity equally between participants. It is most common for one of the participants to lead the interaction, as to teach the other member. Molar activities and dyads form the basis for child development within Bronfenbrenner's theory of ecological development.

In this complex theory of ecological systems, the most immediate system is what Bronfenbrenner (1979, 1986, 1992, 2005) refers to as the microsystem, and consists of a "complex of interrelations within the immediate setting" (Bronfenbrenner, 2005, p. 54). These connections are the most personal and immediate due to their direct relationship with the subject and are denoted as proximal processes. These proximal processes are the most persuasive interrelations that initiate and promote human development. Listening to a mother read a bedtime story, actively participating as a teacher leads a show-and-tell session and paying attention as a pastor is delivering a sermon are common examples of proximal processes a child may encounter within the microsystem.

Interactions between persons within a child's microsystem, but absent of the child, make up the second layer of the ecological system, the mesosystem (Bronfenbrenner, 1979, 1986, 1992, 2005). Parent-teacher conferences, increased school communication between principal and parent, and a parent serving on a church committee are all examples of events that occur within a child's microsystem. The most common forms for parent involvement initiated within the public-school systems of the United States are focused on building relationships that occur within the mesosystem. This fact will be illustrated in future sections. These practices, however, rarely consider the context of the interactions – i.e. parent education level, number of jobs a parent holds, family structure, previous school experience – when attempting to enhance the direct connection between home and school. The interactions that do address deeper contexts often do so at a superficial level.

The exosystem – the third layer of the ecological system – is closely related to the microsystem and includes what Bronfenbrenner calls structures within the microsystem (1979, 1986, 1992, 2005). These structures are events that do not directly interact with the child but occur around the persons and events within the child's microsystem. Examples of such structures would be the job loss of a parent, the financial difficulties that result from the loss of a job or moving from one home to another. Incidents such as these impact the child's development by transforming the intensity, content, and frequency of interrelations between the child and the affected member of the child's microsystem.

The fourth level of Bronfenbrenner's (1979, 1986, 1992, 2005) ecological system is the macrosystem; this level was also the last addressed within the original theory. Bronfenbrenner defined the macrosystem as the "consistency observed within a given culture or subculture in the form and context of its constituent micro-, meso-, and exosystems, as well as belief systems or ideology underlying such consistencies" (1979, p. 258). The development induced through the macrosystem, like the other systems within the ecological theory, varies from individual to individual. Molar activities such as religious and ethnic practices within an individual's subculture have unique impacts on the development of the individual or individuals within a certain sub-group. Still, many of the activities within the greater scope of an individual's culture are impactful across subcultures. These influential activities could be new laws banning the use of cellphones, conflicts among countries, and the fluctuation of oil prices impacting the cost of a gallon of gas. These interactions within the macrosystem may impact a wide range of individuals in varying cultures; nonetheless, the level and effect of the interactions are heavily related to the beliefs and practices within each individual subculture. A direct example of the impact of the macrosystem on parent involvement practices and participation would be new attendance boundaries drawn by the local school board.

The final level of Bronfenbrenner's ecological systems theory (1986, 1992, 2005), a level that was not included in the original model, is the chronosystem, which is described as the impact time has on events and interactions that occur within the other ecological systems. The addition of the chronosystem has led many, including Bronfenbrenner, to refer to the overall theory as the bioecological systems theory (1992, 2005). As discussed earlier, a job loss has an immediate impact within the exosystem. However, as time goes on, the bearing of this major life event continues to affect the development of the individual. One could argue that the consequences directly related to the job loss and a subsequent new job could continue to influence the development of the child without end. In the realm of time impacting educational development, a job change by a parent that creates less time at home can be immediately impactful on the child emotionally, but over the course of a few years, the loss of time for direct interaction between parent and child could have devastating consequences on cognitive development.

Overall Bronfenbrenner's theory of human development considers the interrelationships of process, person, context, and time (1979, 1986, 1992, 2005). Earlier within this section, three of the four – process, context, and time – have been discussed, but Bronfenbrenner elicits that the individual person is paramount to his or her overall development. This is not to say that meaningful connections must always occur for proper human development; instead, human development also is dependent on characteristics attributed to demographics such as age and gender. The dyads and molar activities within each of the systems are influenced by how old the developing human is, and at times, the gender. More specifically, the power player in the dyad, such as a parent, teacher or pastor, may, and most likely will, react differently to a boy versus a girl, or an infant versus a teen. For instance, in a school context, it has been stated that girls develop faster than boys, or that boys are more hyperactive than girls. These preconceived notions could impact how teachers, administrators, and parents interact with these children. Bronfenbrenner pointed out that acknowledging these traits is critical to the understanding of how, and more importantly why, children develop as they do.

Throughout this paper the work of Bronfenbrenner will continue to be examined as the theory relates to both successful and unsuccessful dimensions of parent engagement. The model discussed throughout this section will serve as a starting point for those conversations. The next section will examine the discord created through the various parent involvement studies from 1980 to 2000, and how Bronfenbrenner's theory informs the assorted parent involvement programs and their outcomes.

Early Research on Parent Involvement in Schools

As mentioned in the introduction of this paper, this review of literature is not meant to be a complete synthesis of all parent involvement research; instead each section of this paper has a specific purpose in building an understanding of the most impactful parent involvement practices. The purpose of this section is to investigate the landscape of parent involvement research from 1980 through 2000 in order to illustrate the commonalities that exist in published research, as well as the frequency of conflicting findings in this time period. Because the work of Fan and Chen (2001) is the focal point of the section to follow, the decision was made to analyze most of the studies included in the Fan and Chen meta-analysis (2001) to provide the foundation to this discussion on early parent engagement research. In addition to some of the reports examined by Fan and Chen, other highly popularized studies – defined by frequency of citation – were used to complete this synthesis of early literature.

Parent Involvement and Preschool and Elementary School Students

Many of the initial studies examining parent involvement were focused on the early academic careers of students – preschool through elementary school. Hypothetically, this phenomenon was attributed to the greater impact parent involvement interventions, such as homework help, setting expectations, communication between home and school, and parental presence on the school campus, could have on student outcomes if implemented at a much younger age (Cotton & Wikelund, 1989; Stevenson & Baker, 1987). Early research found that measures of parent involvement practices had positive effects on grades (Griffith, 1998; Hess, Holloway, Dickson, & Price, 1984; Marcon, 1993b), tests scores (Griffith, 1996, 1997; Marcon, 1993b), retention prevention (Marcon, 1993a, 1993b), and overall academic achievement of elementary school children (Hess, Holloway, Dickson, & Price, 1984; Marcon, 1993b; Reynolds, 1992). Studies also found that socio-economic status (SES) (Griffith, 1996), ethnicity (Griffith, 1996), age (Griffith, 1998; Hess, Holloway, Dickson, & Price, 1984; Marcon, 1993a, 1993b), and parent empowerment (Griffith, 1997) impacted the strength of this assortment of relationships between parent involvement and student outcomes.

Research on parent involvement practices during this period showed that academic success in early education could be predicted specifically by a mother's involvement (Hess, Holloway, Dickson, & Price, 1984; Marcon, 1993a, 1993b). When investigating the bearing of parent involvement practices on preschool-aged students, Hess, Holloway, Dickson, and Price (1984) found that parent expectations, especially those of the mother, was the dimension of parent involvement that best predicted school readiness and achievement. Within this longitudinal study, Hess, Holloway, Dickson and Price also found that the impact of a mother's expectations was more influential on students' grades when the expectations were expressed during a child's early years – preschool age – as opposed to during sixth grade. Marcon (1993a, 1993b) conducted a five-year longitudinal study of inner-city African-American students that began with a cohort of preschool-aged children and established that a mother's general involvement in the early education of her child reduced the possibility of third grade retention. Marcon discovered that the effect was less dramatic, yet still significant, if the mother waited until first grade to become engaged. Additionally, Marcon found that if the mother was involved during the first two years of the child's education, there was a positive relationship with students' grades and standardized test scores.

The level of a mother's education was shown to predict student success in a 1987 study conducted by Stevenson and Baker. They concluded that the higher the level of education, the more the overall general involvement of the mother, and the greater the student's achievement, as defined by GPA. As the student progressed from kinder through 6^{th} grade, however, Stevenson and Baker discovered that the impact of a mother's educational level on student GPA was significantly diminished.

Another study found that impact of parent involvement on student success was best predicted by the student's teacher's perception of the level of parent engagement (Reynolds, 1992). Within a longitudinal study of students beginning in Kindergarten, Reynolds found that teacher's perceived level of parent involvement had a greater impact on students' academic success, as defined by overall academic success such as GPA and test grades, than parents' and students' perceptions of parent engagement. In fact, students' perception of parent involvement showed a negative effect on students' academic success. Parent and student reports of involvement at home had no effect on academic outcomes.

Through a series of studies, Griffith (1996, 1997, 1998) discovered that parent involvement predicted students' success on standardized testing and that ethnicity and class moderated this relationship. Griffith (1996) surveyed parents in more than 120 elementary schools within a suburban school district. Results showed that schools where parents reported a high level of parent involvement, based on parents' responses to questions associated with participation in parent-teacher conferences, school functions, and volunteer opportunities at school, had higher state criterion-referenced test (CRT) scores than did the schools where parents did not report high levels of engagement. Griffith (1997) re-investigated the survey data from the

1996 study and established a strong correlation between parent-school interaction, or engagement, and parents feeling both informed by the school and empowered by the school. Still investigating data from the 1996 sample of 122 elementary schools, Griffith (1998) discovered that White parents reported higher school participation than did African-American, Asian, and Latino parents. The reported level of SES, as defined by participation in the federal free and reduced lunch program, predicted levels of parent involvement regardless of race. Griffith also uncovered that parents of younger students, or with more than one child in school, were more likely to be engaged in school activities.

Bronfenbrenner's (1979, 1986, 1992, 2005) theory suggests that the proximal processes located within the microsystem are the most influential on the development of a child. Additionally, the chronosystem is responsible for deepening the impact of these proximal processes over time. The research examined within this section supports Bronfenbrenner's theory by exhibiting the importance of the relationship between parent and child (Griffith, 1996, 1997, 1998; Hess, Holloway, Dickson, & Price, 1984; Marcon, 1993a, 1993b; Reynolds, 1992), and shows that this interaction could be considered to be most critical at an early age (Cotton & Wikelund, 1989; Stevenson & Baker, 1987).

Parent Involvement and Middle School Students

While some argue that the impact of parent involvement is most influential during the preschool and elementary years (Cotton & Wikelund, 1989; Stevenson & Baker, 1987), other research has shown that parent engagement during middle school can also have a lasting effect on student success (Desimone, 1999; Keith, Keith, Troutman, & Bickley, 1993; Keith & Lichtman, 1994; Peng & Wright, 1994; Uguroglu & Walberg, 1986; Yap & Enoki, 1994). Peng and Wright (1994) established that the impact of parent expectations significantly predicted academic outcomes on standardized test scores for a cohort of eight grade students.

Additionally, even though parents were involved in the academics of their children, and high expectations were set, Peng and Wright's research showed that very few Asian parents helped with their child's homework. These parents did, however, enact rules, study times, and help with setting study habits for their eighth-grade students. Yap and Enoki (1994), examining a sample of middle class, mostly Asian and Pacific Islander students, found that home-based practices, such as visits to the library, setting up specific times to study, and providing reading materials at home, predicted improved student attitudes toward school, higher GPAs, and higher scores on standardized tests. Uguroglu and Walberg (1986) found similar results while examining a very different sample of students, a group of suburban middle school students in the Chicago area. Examining a diverse sample made up mostly of White (50%) and African-American (33%) students living in low to middle-class homes, Uguroglu and Walberg found that the home environment, rules, study space, and support from parents, was the best predictor of school success compared to other parent involvement practices such as volunteering at school or communication with a teacher.

Desimone (1999) discovered that parent involvement was a significant predictor of students' math and reading grades in middle school, but that impact, through differing dimensions of parent engagement, fluctuated by ethnicity and race. Employing data from the National Education Longitudinal Study of 1988 (NELS: 88) (Ingels, S. J., Scott, L. A., Taylor, J. R., Owings, J., & Quinn, P., 1998), Desimone investigated the effect of parent involvement practices on academic success for a sample of 24,000 middle school students. Desimone established that general parent involvement practices were a better predictor of grades and test scores in reading and math for White, Asian, and middle-income level students compared to Latino, African-American and low-income students. Desimone also found that the impact of parent involvement practices was more predictive of overall grades than it was for standardized test scores. Contrary to the findings of Reynolds (1992), Desimone (1999) discovered that student perceptions, compared to teacher perceptions, of parent involvement had the strongest association with student achievement – measured by both grades and tests – and that this held across all ethnicity and income levels. The most interesting discovery may have been that while parent involvement practices were the strongest predictors of academic outcomes for all ethnicities, the strength of the effect of individual dimensions of parent involvement on academic outcomes varied across ethnicities. For example, Desimone found that the parent involvement dimension of volunteering at school best predicted the academic success of White students, while having their parents attending PTO meetings was the best predictor of academic success for African-American students. These conclusions from Desimone would support Bronfenbrenner's (1979, 1986, 1992, 2005) ecological theory as a foundation of impactful parent involvement practices. The differences unearthed within Desimone's research point to the impact human development has on the influence of educational practices on academic success, and that culture and SES are critical variables in the development of these relationships.

McNeal (1999) also investigated data from NELS: 88 to examine the relationship between parents, students, and students' behaviors and academic accomplishments. McNeal's research was one of the first to popularize the theory that student outcomes were not the results of single encounters, but a result of the numerous experiences of the child influenced by the social capital (the combined benefit of belonging to a specific group or groups) of the student's family. McNeal found that the influence of social capital on student outcomes was greater for characteristics associated with behaviors then those associated with academics. He also found that this relationship was most influential on those groups that have historically been considered privileged (white middle- and upper-class students). While McNeal did not initially place the moniker of ecological theory on this approach, he did cite Bronfenbrenner in later work, and he referred to his future work through a lens of an “ecological context of parent involvement” (McNeal, 2014, p.2).

Much of the research in this section established that parent involvement has a significant impact on student outcomes in middle school. However, other researchers such as Grolnick and Slowiaczek (1994) discovered that student ability and perception of ability predicted parent involvement, rather than the other way around. Stevenson and Baker (1987) also noted that the impact of parent involvement, while still significant, decreases as the child progresses through middle and high school.

The research findings discussed within this section, specifically those of Desimone (1999) and McNeal (1999), highlighted the critical need to evaluate the impact of parent involvement by first understanding the stakeholders being measured. Both Desimone and McNeal discovered that ethnicity and SES played a major role in the strength of impact that parent involvement practices have on students’ academic outcomes. These findings support Bronfenbrenner’s (1979, 1986, 1992, 2005) theory of ecological development as the lens through which parent involvement practices should be viewed.

Parent Involvement and High School Students

The impact of involvement on students’ academic outcomes is not limited to elementary and middle school students. High school students’ perception of parent involvement has been shown to predict overall academic achievement (Brown & Madhere, 1996; Eagle, 1989; Taylor, 1996; Fehrmann, Keith, & Reimers, 1987; Paulson, 1994b). Fehrmann, Keith, and Reimers (1987) analyzed data from the National Center for Education Statistics’ High School and Beyond National Study (HSB) and found that student perceptions of general parent involvement had a significantly positive impact on overall grades, but the study was inconclusive on which was more impactful, student perception of parent involvement or actual parent involvement.

Similarly, Eagle (1989) found that parent involvement during high school, as gauged by students' self-report, had a significant impact on high school students' academic attainment (measured by attainment of a high school diploma or a college degree). Eagle also found that SES and parental education attainment, regardless of the influence of parent involvement, significantly predicted students' academic attainment.

The findings are mixed with regards to the impact parenting style has on academic achievement on high school students. In a study of 6400 adolescent students (ages 14 to 18) with diverse ethnicities and SES, Steinberg, Lamborn, Dornbusch, and Darling (1992) found that general parent involvement significantly influenced student achievement, but that the relationship was stronger if the student resided in an authoritative household. All variables were self-reported by students via a survey, and the school achievement variable consisted of four questions related to GPA, effort in class, time spent on homework, and time spent daydreaming in class. Conversely, Taylor, Hinton, and Wilson (1995) found that an authoritative parenting style had a negative relationship with perceived parent involvement and in turn, produced lower academic achievement in low-SES African-American students across all age groups.

Paulson (1994b), while investigating the impact of students' perception of parent involvement on academic achievement, found that students' self-report of parent involvement predicted academic achievement. While parents' and students' self-reported measures on parent engagement were slightly correlated, parent perceptions did not significantly predict student outcomes, but student perceptions did. Further, students' perception of paternal interest had a slightly higher effect than that of maternal interest. Additionally, the earlier parents expressed an interest or expectation of school outcomes, the greater the impact on students' expectations to attend college. In a similar environment, Paulson (1994a) investigated the role gender had in moderating the impact of the perception of parent involvement on student achievement. In a study of ninth grade students, Paulson discovered that the more boys perceived that their parents were demanding and valued academics, the higher the academic achievement. Conversely, the more boys perceived that their parents were involved in their education, the lower the GPA of the student. Paulson discovered no significant effect either way when investigating the same relationships for girls.

The research considered within this section continued establishing the positive impacts of parent involvement, this time on high school students. However, it was made apparent that within high school students, perceptions of parent involvement (Fehrmann, Keith, & Reimers, 1987; Paulson, 1994a, 1994b) and parenting styles (Steinberg, Lamborn, Dornbusch, & Darling, 1992; Taylor, Hinton, & Wilson, 1995) were key contributors to the effects on students' academic outcomes. The research evaluated within this section confirmed the importance of consideration of demographics such as ethnicity (Eagle, 1989; Paulson, 1994a, 1994b), SES (Eagle, 1989; Taylor, Hinton, & Wilson, 1995), and gender (Paulson, 1994a, 1994b) when evaluating the impact of parent involvement, as Bronfenbrenner's (1979, 1986, 1992, 2005) theory would suggest.

Early Theories on Parent Involvement

As research on the topic of parent involvement progressed toward the new millennium, two theories arose as the most frequently retained when providing a framework for the discussion. Epstein's six types of parental involvement (1988, 1989) and the Hoover-Dempsey and Sandler Model of Parent Involvement (1995, 1997) became popularized in the late 1990s as two models that experts would employ when establishing a theoretical framework for their research. Epstein's (1988, 1989) model of six types of parent involvement (see figure 2) explores the relationship between parent and student through multiple layers of interactions, both directly and indirectly. This model employed by Epstein could very easily be examined through the

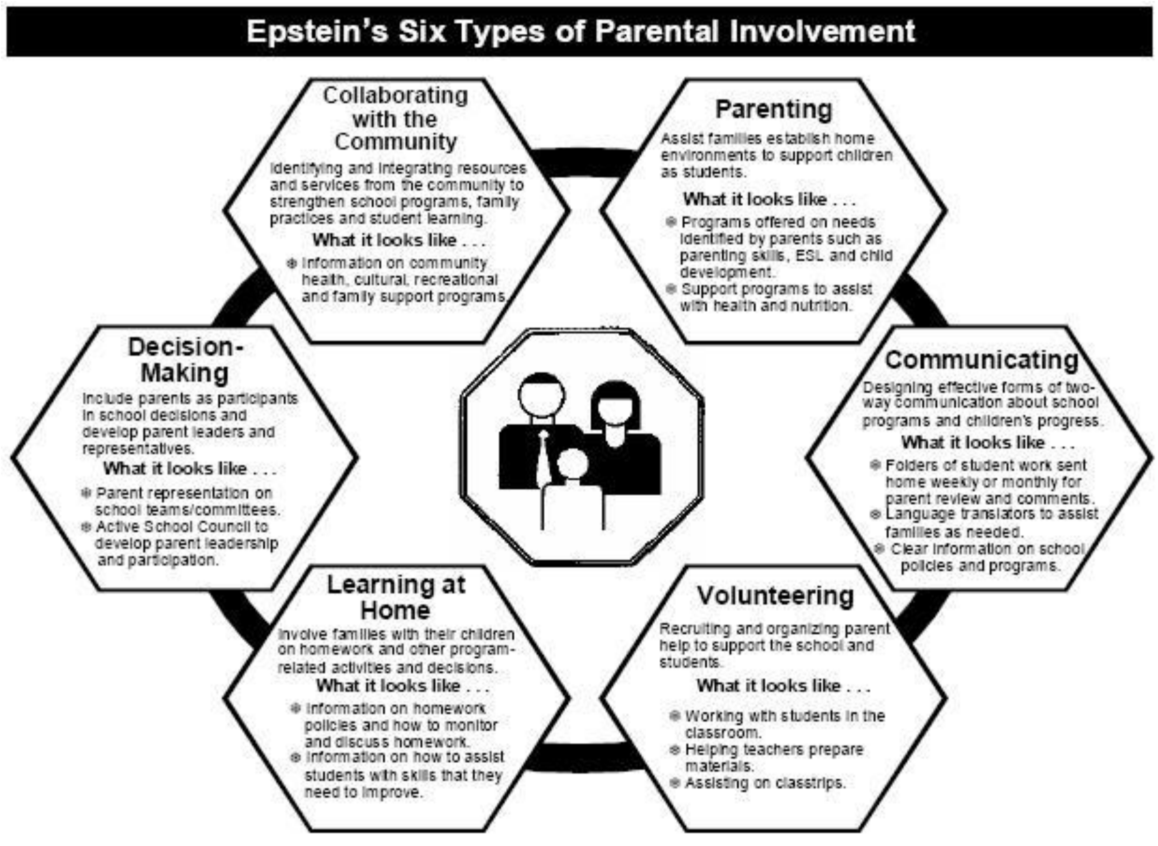


Figure 2. A representation of Epstein's six types of parental involvement

(Source: Hamilton-Wentworth District School Board, n.d.)

theoretical scope of Bronfenbrenner's theory of ecological systems (1979, 1986, 1992, 2005) in order to determine which relationships within Bronfenbrenner's theory are most common and most influential within Epstein's model.

Epstein defined six types of parent involvement that she surmised would increase school effectiveness (1988, 1989). All six specified areas – parenting support, facilitating communication, encouraging volunteerism, fostering home learning, including parents in school decisions, and community activities –address the improvement of parenting skills that impact direct relationships between the parent and the student – the microsystem – or relationships between the parent and teachers or school administration – the mesosystem. Variations of parent support activities such as helping a parent to attain a GED and assisting in a job search go beyond microsystem interactions. A majority of the events that make up community activities can be viewed as relationships within the other five systems as these activities are impacted by direct relationships (microsystem), interactions between relationships (mesosystem), education, local, and state policies (exosystem), and local custom and culture (macrosystem).

Hoover-Dempsey and Sandler posit a five-level theory of parent involvement – the decision to become involved, the parent's choice of the type of involvement, the different mechanisms in which parent involvement impacts student outcomes, mediating variables of the effect of parent involvement on student outcomes, and student outcomes – that suggests the impact of parent involvement is an evolutionary process (1995,1997). This proposed evolution of the parent involvement process, in theory, relates directly to Bronfenbrenner's ecological systems theory (1979, 1986, 1992, 2005) by evaluating constructs and relationships that promote parent involvement, and how those constructs directly and indirectly impact the student outcomes, or more precisely, the development of the child.

The first level of parent involvement in the Hoover-Dempsey & Sandler (1995, 1997) Model of Parent Involvement, the parent's decision to become involved in the education of his or her child, theorizes on the impact that previous parent experiences have had on the parent's decision to participate in the education of the child. The constructs that led to the parent's decision of becoming involved have been influenced by the parent's cultural belief system (macrosystem), his or her experiences with educational and civil policies (exosystem), relationships between parent and teacher (mesosystem), direct interaction with the child (microsystem) and have been built over time (chronosystem) (Bronfenbrenner, 1979, 1986, 1992, 2005). The second level, the parent's decision on which type of parent involvement to participate in, is influenced by similar factors. Relationships within the final three stages of the

Hoover-Dempsey and Sandler model exist mainly within relationships that mirror Bronfenbrenner's (1979,1985, 1992, 2005) microsystem, mesosystem, and exosystem.

This section set out to investigate early research on parent engagement and why findings were often conflicting with one another. Through this investigation, it has also become apparent that as the decade of the 1990s approached an end, researchers began viewing parent involvement as more than just a direct relationship between child and parent, or parent and school, instead considering age (Cotton & Wikelund, 1989; Griffith, 1998; Hess, Holloway, Dickson, & Price, 1984; Marcon, 1993a, 1993b; Stevenson & Baker, 1987), gender (Paulson, 1994a), SES (Desimone, 1999; McNeal, 1999), ethnicity (Eagle, 1989; Paulson, 1994a, 1994b), parent education (Stevenson & Baker, 1987) and social capital (McNeal, 1999) as variables impacting the desire to participate as well as the effectiveness of parent involvement practices (Fehrmann, Keith, & Reimers, 1987; Paulsen, 1994b; McNeal, 1999). Models established by Epstein (1988, 1989) and Hoover-Dempsey and Sandler (1995, 1997) helped to spur on the evaluation of parent involvement practices employing these variables, enabling the inspection of a much wider range of relationships. The next section of this paper will continue to examine the multiple relationships impacting parent involvement practices to determine which dimensions have the greatest bearing on student outcomes, as well as discovering which relationships possess the highest likelihood for change.

Making Sense of the Discord

Noting that most of the research on parent involvement was not experimental, and that the sparse research that was empirical reported conflicting findings, Fan and Chen (2001) sought to clarify the dissonance within parent involvement research by performing a meta-analysis. Fan and Chen's meta-analysis began to give meaning to parent involvement by defining the practices and analyzing the effects parent involvement had on students' academic achievement. Fan and

Chen's work also spurred additional studies that would seek to further define the impact of parent involvement within specific groups (e.g., ethnicity, gender, age, SES). Expanding on the findings of Fan and Chen, Jeynes (2003), also using a meta-analysis, investigated the relationship between parent involvement and minority students' academic achievement. A few years later Jeynes (2005) examined parent involvement research by examining the impact of parent involvement on the academic performance of elementary-aged children attending urban schools. A follow-up meta-analysis of studies investigated the influence of parent involvement on the academic success in secondary urban school children (Jeynes, 2007).

Rothman and colleagues describe a meta-analysis as a statistical method used to analyze results from multiple studies (Rothman, Greenland, & Lash, 2008). The comparison of results from multiple studies is utilized to make conclusions about the existence of relationships. In the early 2000s, Fan and Chen (2001), and Jeynes (2003, 2005, 2007) used meta-analyses to attempt to explain the relationship between parent involvement and student academic outcomes. This section will examine in detail these studies and assess the contributions that these studies have had on developing greater lucidity within the field of parent involvement research.

Parent Expectations Driving Academic Outcomes

Whether it was through the ability to anticipate the coming importance placed on parent involvement practices by the federal government, or it was completely coincidental, the research of Fan and Chen (2001) came at a critical time in the history of parent involvement. As the 20th century ended, and the debate on the impact of parent involvement on student academic outcomes continued, *No Child Left Behind* (No Child Left Behind [NCLB], 2002) and the federal dollars accompanying its programs fueled the flames of discord. NCLB required Title I schools to employ parent involvement programs to address the educational gap that continued to exist within most inner-city schools in hopes of increasing academic performance. Realizing that educators, lawmakers, and parents were becoming increasingly enamored with the possibility of parent involvement having positive effects on student success, and that most of the current research on the topic produced contradictory results, Fan and Chen's (2001) meta-analysis sought to add clarity to the topic. Fan and Chen argued that much of the conflict surrounding the impact of parent involvement had to do with the wide variety of definitions used in empirical studies, as well as in common discussions of parent involvement practices. Employing a meta-analysis, Fan and Chen assessed the relationship between parent involvement indicators and students' academic outcomes. They acknowledged the breadth of qualitative work published with regards to parent involvement, but by definition a meta-analysis is a statistical approach to summarizing quantitative research on a specific topic. They argued that examining the relationship between parent involvement indicators and academic outcomes is more impactful through the study of empirical research. Still, the quantitative studies were conflicting in findings due to "vast inconsistencies" (Fan & Chen, 2001, p. 1) in defining parent involvement and measurable outcomes.

Fan and Chen (2001) established three major parameters when developing the requirements of their meta-analysis on parent involvement. The considerations set forth were that the studies had reported their own empirical findings, had taken place between 1980 and 2000, and had reported significant Pearson correlations between the parent involvement indicators and the various academic outcomes. The first consideration enacted by Fan and Chen was logical because empirical results must be reported to evaluate a study through the use of a meta-analysis. Including the requirement that the authors of each study must report their own findings prevents the duplicate correlations being used in the calculation of the meta-analysis results. To assure that only the most recent results were included in their meta-analysis, Fan and Chen's second condition limited the studies reviewed to only those performed between 1980 and

2000. Ultimately, only three of the twenty-five studies incorporated in the meta-analysis were performed prior to 1992, allowing Fan and Chen to accomplish the goal of using only the latest findings. Fan and Chen suggested that results provided using regression and path analysis models were often confounded by other variables in the analysis. They decided that these statistical methods were not amicable modes of analysis when performing a meta-analysis; hence the requirement that bivariate relationships obtained from the Pearson correlations must be present to represent the relationship between study variables. Twenty-five studies met the criteria Fan and Chen set forth for final inclusion in the meta-analysis, producing 92 unique Pearson correlations between parent involvement practices and academic outcomes.

In the examination of the twenty-five studies that met their strict parameters, Fan and Chen (2001) found many differences in the operational definition of both parent involvement and the associated outcome variables related to academic achievement. Because of the generalization of parent involvement activities (Barnard, 2004; Davis-Kean, 2005; Fan & Chen, 2001; Jacobs & Harvey, 2005), the ability to accurately measure the impact of parent involvement on students' academic outcomes relies greatly on the ability to clearly define specific types of parent involvement practices, as well as specific forms of academic achievement. In order to explain what action was having an impact on specific academic outcomes, Fan and Chen (2001) divided parent involvement indicators from the 25 studies into five distinct categories: parent expectations of and aspirations for their children, communication with children on school-related topics, parent participation in school-related events, home structure and parental supervision of children with regards to school matters, and general parent involvement practices not included in the other four indicators. Fan and Chen also segmented varying forms of academic achievement within their study. Student achievement was defined by two factors, measurement and area of academic achievement. Fan and Chen defined the different measures of academic achievement as school GPA, test scores, and other. The category of other included variables such as retention, graduation, and teacher's perceptions. Academic achievement categories included math, reading, sciences, social studies, other, and a general category. The category defined as other consisted of overall aptitude measures as well as subjects that were defined, but not related to the four subjects mentioned previously. General was the category used to explain those subjects that were not clearly identified or left unspecified in their previous study.

The first analysis undertaken by Fan and Chen (2001) was to test for moderating factors of the relationship between parent involvement and academic achievement using general linear modeling (GLM). The moderating variables included in the inquiry were age, ethnicity, measure of academic achievement, area of academic achievement, and parent involvement dimensions. During the initial evaluation, Fan and Chen did not scrutinize specific types of academic measure, area of academics, or parent involvement dimensions. The results using the transformed Fisher's *z'*s indicated that age ($z = 5.09$), ethnicity ($z = 5.68$), area of academic achievement ($z = 27.89$), and parental involvement dimensions ($z = 26.60$) all had statistically significant moderating effects on the dependent variable, students' academic achievement. Measure of academic achievement ($z = 1.13$) was shown to have no moderating effect. Fan and Chen noted that the results suggested, "the relationship between parental involvement and students' academic achievement should not be generalized across different operational definitions of parental involvement, nor should it be generalized across different areas of academic achievement" (2001, p.11). Because age and ethnicity had a significant, but small moderating effect, Fan and Chen chose to omit these two variables from future analysis.

In order to investigate the impact of specific components within the area of academic achievement and dimensions of parent involvement, Fan and Chen (2001) used correlation coefficients to identify the strengths of relationships among effect sizes. Fan and Chen first calculated an overall effect size by averaging all the studies ($r = .25$). This result would indicate a medium effect size using Cohen's suggestion that within the social sciences a medium effect size should be considered when $r = .30$ (Cohen, 1988). Fan and Chen then calculated the effect sizes with specific groupings of studies investigating individual variables within the area of academic achievement – math ($r = .18$), reading ($r = .18$), science ($r = .15$), social studies ($r = .18$), other ($r = .34$), and general ($r = .33$) – and parent involvement dimensions – aspirations / expectations ($r = .40$), communication ($r = .19$), supervision ($r = .09$), participation ($r = .32$), and other ($r = .29$). The results suggest that individual subjects may not be the best way to examine the overall impact of parent involvement on students' achievement. Instead, the strongest correlations between parent involvement and academic achievement appear to occur when a students' overall performance is considered. Fan and Chen noted that this made sense because parent involvement practices are not normally focused on a singular subject, but on the student, or students, as a whole.

The parent involvement dimension that had the strongest correlation to students' academic achievement, according to Fan and Chen's (2001) meta-analysis, was parent expectations / aspirations. Parent participation and the category capturing all other forms of parent involvement, as previously defined by Fan and Chen, were also strongly related to students' academic outcomes. Expectations and aspirations could not be separated in the analysis because there were too few studies included in the meta-analysis (25). However, while these terms are related, they are uniquely different. Jacobs and Harvey (2005) operationally defined expectations and aspirations in their research. Their use of *expected* results to define expectations and *desired* results to define aspirations clearly delineated a difference between the two terms and supported the theory that the two parent involvement indicators should be investigated individually. These findings were important to the field of parent involvement as they began to give a sense of the impact of parent involvement practices using focused definitions of both the practices and the outcomes.

Unlike the impact of parent expectations, parent supervision had the weakest relationship to students' achievement (Fan & Chen, 2001). Although Fan and Chen found that parental supervision had the weakest relationship to predicting academic outcomes of those variables they observed, it is essential to note that the results regarding this weak association may be skewed by the fact that parents may involve themselves more frequently in student supervision if the child is already struggling academically (Carpenter, 2008; Fan & Chen, 2001). For example, when a student is failing a class at the first reporting mark, parents may become more engaged in the home supervision. The timing of the participation may mitigate the impact of the association on the current year's academic achievement. However, Fan and Chen warn against discounting the impact of parent supervision based on their results, noting the possible confounding variables, as well as the limited number of studies used in the meta-analysis.

Fan and Chen's (2001) work was a critical contribution to the emerging topic of parent involvement research. Through the 1980s and 1990s, research on the topic of parent involvement ostensibly contradicted itself. Fan and Chen added some clarity through their findings by defining parent involvement indicators and academic outcomes and assessing the strength of those relationships. While the work was essential to spurring new focused research, such as that of Jeynes, it was not without limitations. Fan and Chen themselves noted that their study was limited by the lack of empirical research that met their established criteria – only 25 studies were reviewed. It could also be argued that it was a misstep by Fan and Chen to omit age and ethnicity from their final analysis due to the relatively small practical significance age and ethnicity had on students' academic achievement, as previous studies found that both age (Eccles

& Harold, 1993; Hoover-Dempsey, Bassier, & Brissie, 1987) and ethnicity (Desimone, 1999; Hao & Bonstead-Bruns, 1998; McNeal, 1999) moderated the relationship between parent involvement and student outcomes. Finally, the lack of analysis of the socio-economic status (SES) variable is glaring. Earlier studies found that there is a direct relationship between a child's SES and the impact of parent involvement on a student's academic success (Desimone, 1999; Hoover-Dempsey, Bassier, & Brissie, 1987; McNeal, 1999; Sui-Chu & Willms, 1996). The second and third limitations are addressed in the works of Jeynes, and many of the individual studies that will be examined in the final section of this paper.

The Impact of Parent Expectations on Urban Students' Academic Achievement

Shortly following the work of Fan and Chen (2001), Jeynes (2003, 2005, 2007) embarked on a series of three meta-analysis studies that confirmed some of the findings of his predecessors and expanded the research to include SES, age (Jeynes, 2005, 2007), and ethnicity (Jeynes, 2003, 2005, 2007). The addition of SES, age, and ethnicity as variables moderating the impact of parent involvement on students' academic achievement corroborated findings from earlier research that included age (Eccles & Harold, 1993; Hoover-Dempsey, Bassier, & Brissie, 1987), SES (Desimone, 1999; Hoover-Dempsey, Bassier, & Brissie, 1987; McNeal, 1999; Sui-Chu & Willms, 1996), and race (Desimone, 1999; Hao & Bonstead-Bruns, 1998; McNeal, 1999) as factors, in addition to supporting Bronfenbrenner's ecological systems theory (1979, 1986, 1992, 2005). In 2003, Jeynes addressed socio-economic status (SES) and ethnicity while analyzing the impact of parent involvement on minority students' academic achievement. The impact of age as a moderating factor between parent involvement and students' academic achievement was investigated by Jeynes in 2005 – impact of parent involvement on the academic achievement of urban elementary students – and in 2007 – impact of parent involvement on the academic achievement of urban secondary students. The addition of these three variables echoes the idea that parent involvement is not just a simple relationship – or limited to the micro-system – as SES, age, and ethnicity can impact human development across all systems in Bronfenbrenner's theory (1979, 1986, 1992, 2005).

Within all three meta-analyses conducted by Jeynes (2003, 2005, 2007), the quality of the study was investigated as a predictor of the relationship between parent involvement and student academic outcomes. None of the meta-analyses conducted found any relationship between the quality of study and the impact of parent involvement on academic outcomes. Hence, this variable is not addressed within any of the three sub-sections that follow.

Jeynes (2003), through a meta-analysis, investigated the impact of parent involvement on the academic performance of urban students. Although specific study criteria were not mentioned, requirements of urban students included in the study, specific parent involvement measures, and statistical information that would allow for the calculation of effect sizes seemed to be underlying necessities. Following the lead of Fan and Chen (2001), Jeynes divided the dimensions of parent involvement from the 21 studies he investigated into groupings so that he could study the impact of parent involvement on student success and determine if any of the indicators had differing effects compared to the others considered (Jeynes, 2003). Jeynes' study employed some categories similar to those employed by Fan and Chen – parent attendance at school functions, parent communication with the school, parent expectations of students, and parents assisting student with homework – and other categories of parent involvement that were newly created – parents implementing rules related to school at home, parenting styles, and parents reading to their children. Jeynes grouped students' academic achievement into four different outcome variables – overall academic performance, grades, standardized testing, and general academic measures. The category of general academic measures was a catchall category that consisted of measures such as teacher ratings. Jeynes' 2003 research expanded upon Fan and Chen's work by adding ethnicity and gender variables to the meta-analysis. The ethnicity categories used in the analysis were as follows: mostly African-American, all African-American, mostly Asian-American, all Asian-American, mostly Latino and Asian-American, and all Latino and Asian-American.

In the analysis, Jeynes evaluated effect sizes of combined parent involvement studies that studied similar variables using Hedges *g* (2003), noting that Hedges *g* was a more conservative estimate of effect size than Cohen's *d* (Hedges, 1981; Jeynes 2003). Hedges stated, "unlike statistical significance, effect sizes represent strength of relationships without regard to sample size" (Hedges, 2008, p.167). Because the sample sizes within the studies used in most meta-analyses differ, the use of effect sizes (as opposed to *p*-values) yields a more accurate picture of the practical significance of the results. For the social sciences, effect sizes are considered small at .10, medium at .30, and large at .50 (Cohen, 1988, 1992).

The results from Jeynes' (2003) analysis showed that the statistically significant relationship between general parent involvement and overall academic performance was strongest for those studies that consisted of mostly African-Americans ($g = .44$), all African-Americans ($g = .48$), mostly Latino and Asian-Americans ($g = .43$), and all Latino and Asian-Americans ($g = .48$), all possessing large effect sizes. The relationship was weakest for studies consisting of mostly or all Asian-American students ($g = .22$). The only other academic category that had all ethnic groups represented in at least one study was standardized testing. Results were similar, and also statistically significant, for studies containing mostly Latino and Asian-Americans ($g = .43$), all Latino and Asian-Americans ($g = .48$), and mostly or all Asian-American students ($g = .22$). However, compared to overall academic performance, the relationship between general parent involvement and student performance showed medium effect sizes for studies investigating mostly African-American students ($g = .32$) or all African-

American students (*g* = .33). These findings would suggest that general parent involvement practices have a strong positive relationship with student overall academic performance and standardized test scores in African-American and Latino students, although the strength of the relationship between general parent involvement and standardized test scores is slightly weaker for African-American students than the relationship between general parent involvement practices and overall academic outcomes.

Since overall parent involvement practices had the strongest relationship with overall academic achievement, Jeynes (2003) investigated this relationship further by studying the effect sizes between individual parent involvement indicators and overall academic outcomes. Four indicators – parenting style, parental attendance, reading at home, and rules set at home – were represented in studies included in the meta-analysis that investigated each ethnic group analyzed by Jeynes. Parenting style had a statistically significant relationship with overall academic outcomes in studies with mostly or all African-American students (*g* = .44), but virtually no relationship with any other of the ethnic groups evaluated in this study. Similarly, parent attendance had the strongest relationship (also statistically significant) on overall academic achievement in studies with mostly African American students (*g* = .51). However, in studies with either Asian-American students or Latino and Asian-American students, the non-statistically significant relationship was negative (*g* = -.29). These findings would indicate that the impact of parenting style and parent attendance at school functions has a stronger impact on the overall academic performance of African-American students than it has on Latino and Asian-American students. Setting rules at home did not have a statistically significant relationship with overall academic outcomes for any of the individual ethnic groups, denoting that the impact of this form of parent involvement may not differ between African-American, Asian-American, and Latino students. However, the relationship between reading at home and overall academic performance was statistically significant in studies consisting of Latino and Asian-Americans (*g* = .21), and only Asian-American students (*g* = .21).

There were two areas of parent involvement studied by Jeynes (2003) in which only studies containing African-American students were included in the meta-analysis – parent expectations and homework assistance. Supporting the findings of Fan and Chen (2001), Jeynes (2003) found that the relationship between parent expectations and overall academic achievement was statistically significant for African-American students (*g* = .57). Contrary to the findings of Fan and Chen (2001), Jeynes (2003) found that a positive relationship between parent homework assistance and overall academic outcomes existed for African-American students (*g* = .57). The latter findings would indicate a need for further research on the relationship between parent homework help and student academic success, because as with Fan and Chen (2001), Jeynes' (2003) research is limited by the number of studies included within the analysis.

Overall, Jeynes (2003) found that ethnicity did moderate the relationship between parent involvement and student academic outcomes, and that some parent involvement indicators had a greater impact on some ethnic groups than on others. Jeynes also investigated whether gender moderated the relationship between parent involvement and student academic outcomes and found no evidence of a difference. While Jeynes' 2003 work illuminated the fact that different parent involvement practices are more impactful to some ethnic groups than to others, the study was limited by the overall number of empirical studies available, as well as the lack of diversity in ethnic groups of the studies investigating the different dimensions of parent involvement.

The effect of parent expectations on elementary students. Following up his work from 2003, Jeynes embarked on a second meta-analysis. This time Jeynes investigated the impact that parent involvement practices had on urban elementary school students. Jeynes was able to examine 41 studies that met the following criteria: (a) being published or unpublished, (b) the presence of a measurable parent involvement variable, (c) enough statistical data to calculate an effect size, (d) the presence of a true control group (if a control group was used), and (e) an urban elementary environment for the study. As in 2003, Jeynes used the more conservative Hedges *g* (Hedges, 1981) to calculate effect sizes due to its use of a pooled standard deviation in the denominator. The variables assessed in the 2005 meta-analysis mirrored those Jeynes employed in 2003. Parent involvement practices were divided into seven categories – parent attendance at school functions, parent communication with the school, parent expectations of students, parents assisting student with homework, parent implementing school-related rules at home, parenting styles, and parents reading to their children – and students' academic achievement into four – overall academic performance, grades, standardized testing, and general academic measures (Jeynes 2003, 2005).

Aside from examining only elementary school students, there were two other major differences in Jeynes' 2005 meta-analysis compared to the one developed in 2003. The first was to determine if there was a difference between the studies with sophisticated controls and those without. Sophisticated controls described those studies that reported on age, ethnicity, SES, and previous achievement. The second major difference was the evaluation of parent involvement programs, as well as parent involvement practices. In the previous study, Jeynes only looked at those practices directly attributed to parents. By adding parent involvement programs, he extended the analysis to include school attributes.

Jeynes (2005) found that general parent involvement practices yielded strong effect sizes when analyzing the impact of these practices on overall academic performance ($g = .75$, $p < .01$), grades ($g = .85$, $p < .0001$), and standardized tests ($g = .40$, $p < .01$) in studies without sophisticated controls, and very similar results in studies that did included sophisticated controls

- overall academic performance ($g = .73, p < .01$), grades ($g = .86, p < .0001$), and standardized tests ($g = .21, p < .01$). These results would point to no real differences between the two types of studies on the impact of general parent involvement practices on these three academic outcomes. When analyzing the same outcome variables in relation to parent involvement programs, studies without sophisticated controls reported significant results for overall academic performance ($g = .31, p < .05$), other ($g = .30, p < .05$), and standardized tests ($g = .40, p < .01$). Only one category, overall academic performance, had multiple studies that used sophisticated controls for use in this meta-analysis. The findings were statistically significant at $g = .19, p < .05$. Of importance is the finding that when considering studies specifically on parent involvement programs, those with sophisticated controls were deemed by Jeynes to be homogenous, while those without sophisticated controls were considered heterogeneous. Even more important to the field of parent involvement was that Jeynes' findings conflict with those of Mattingly and associates who found no impact from parent involvement programs on students' academic success (Mattingly, et al., 2002).

When analyzing the impact of individual dimensions of parent involvement practices, Jeynes' 2005 findings confirmed those of Fan and Chens' 2001 meta-analysis – parental expectations produced the largest effect size of all the parent involvement dimensions. An effect size of $g = .58$ ($p < .05$) was calculated for overall achievement when combining studies including a parent expectations variable. Also corroborating the findings of Fan and Chen (2001), parent's assistance in homework produced the lowest effect size ($g = -.08$) and was not statistically significant (Jeynes, 2005).

Finally, results from the meta-analysis showed that the impact of parent involvement practices was reflected across race and gender (Jeynes, 2005). Effect sizes were considered large (Cohen, 1988, 1992) for general parent involvement on overall academic achievement in studies without sophisticated controls, and were similar for boys ($g = .52, p < .001$) and girls ($g = .62, p < .01$) with no statistically significant difference between genders. Of the studies in the meta-analysis that used sophisticated controls, none divided participants by gender. The impact of general parent involvement practices on academic outcomes also held across ethnicities. Effect sizes were considered large for studies using sophisticated controls ($g = .84, p < .0001$) and for those without sophisticated controls ($g = 1.06, p < .0001$). These results were not statistically significantly different than the effect sizes seen in studies with all or mostly white students.

The number of studies analyzed in Jeynes' 2005 meta-analysis was more than double the number used previously by Fan and Chen (2001) (21 studies) and Jeynes (2003) (20 studies). However, because Jeynes chose to evaluate so many different independent and dependent variables, the number of studies was still a limitation. There were many groups who were not represented in certain evaluations, due to no studies pertaining to that specific group. This is an inherent problem with meta-analysis studies and will always be a challenge to those studies that seek to use variables such as race and age to summarize research in a given field. Additionally, while Jeynes claims his 2005 study also examined race, this claim could be better characterized as a study that examined the impact of parent involvement practices on the academic outcomes of minority students, as the variables used to define race were studies that contain all white students, all minority students, or mostly minority students (Jeynes, 2005).

The effect of parent expectations on secondary students. The final meta-analyses, of the three conducted by Jeynes, that focused on the impact of parent involvement on student academic success was published in 2007 and investigated studies that reported on the relationship of parent involvement and academic outcomes for urban secondary students (2007). This 2007 report was very similar to the 2005 meta-analysis published by Jeynes, differing only by the age of students investigated. Fifty-two studies were used in Jeynes' 2007 meta-analysis, all meeting the following requirements: (a) the variable of parent involvement had to be measurable as an individual variable, (b) statistical information in the study must be present in order to calculate effect sizes, (c) if a control group was used, it must be a true control group, and (d) the study had to take place in an urban secondary school. For purposes of this meta-analysis, Jeynes did not eliminate a study if it was not published.

Jeynes used the same categorical groups for independent and dependent variables as in his 2003 and 2005 studies. The independent variables, or the differing dimensions of parent involvement, were divided into seven categories – parent attendance at school functions, parent communication with the school, parent expectations of students, parents assisting student with homework, parent implementing rules related to school at home, parenting styles, and parents reading to their children (Jeynes, 2003, 2005, 2007). The outcome variables were associated with students' academic achievement and were divided into four separate and distinct categories – overall academic performance, grades, standardized testing, and general academic measures. Similar to the 2005 study that claimed to examine race, the race variable was divided into studies that examined (a) all white students, (b) all minority students, and (c) mostly minority students (Jeynes, 2005, 2007). For the purpose of his 2007 meta-analysis, Jeynes defined secondary school as grades 6^{th} through 12^{th} (Jeynes, 2007).

As in his previous two meta-analyses, Jeynes used Hedges *g* to calculate effect sizes (Jeynes, 2003, 2005, 2007). Hedges g is considered to be a more conservative approach compared to Cohen's *d* due to its use of a pooled standard deviation in the denominator (Hedges, 1981). Additionally, Jeynes addressed studies that had small samples sizes by employing "conversion formulas used by Glass, McGaw, and Smith" (Jeynes, 2007, p. 88). Jeynes also evaluated studies, as in 2005, by defining them as using sophisticated controls (evaluating age, race, and SES within the study) or not reporting the use of sophisticated controls.

When examining effect sizes for general parent involvement in relation to academic outcomes, all reported effect sizes were considered to be medium to large (Cohen, 1988, 1992) and significant for studies with and without the use of sophisticated controls (Jeynes, 2007). The effect size for general parent involvement and overall academic performance without controls was at $g = .53$, $p < .0001$. For similar studies with controls, a smaller effect size was produced at $g = .38$, $p < .05$. Standardized testing and general overall parent involvement produced the largest effect size at $g = .55$, $p < .0001$ for studies not using sophisticated controls, and a $g = .37$ effect size ($p < .05$) for those studies that employed sophisticated controls. These findings confirm the previous finding of Jeynes (2003, 2005) and Fan and Chen (2001), that overall parent involvement has a significant and positive impact on the academic outcomes of students. Additionally, parent involvement in relation to overall academic success and standardized testing continues to produce larger effect sizes than with other academic outcomes (Jeynes, 2007).

While none of the studies included in the 2007 meta-analysis investigated parent involvement programs using sophisticated controls, there were significant findings (Jeynes, 2007). The examination of parent involvement practices and overall academic achievement ($g = .35$, $p < .05$), grades ($g = .25$, $p < .001$), and other academic measures ($g = .25$, $p < .001$) all produced medium effect sizes (Cohen, 1988, 1992). While the relationship for standardized testing and programs of parental involvement produced a medium effect size ($g = .36$), the results were not statistically significant. Jeynes' findings support his early results that parent involvement programs have a positive effect on students' academic outcomes (Jeynes, 2005, 2007), and contradict Mattingly and associates' 2002 conclusions (Mattingly, et al., 2002). The urban setting of these studies makes the finding even more important as many of the Title I schools served through NCLB are in urban areas (NCLB, 2001). The positive results would endorse one of the primary focuses of NCLB, which is to direct the involvement of parents in the education of their children, both at home and in the school.

When Jeynes examined the impact of each individual dimension of parent involvement on specific academic outcomes, the findings continued to support parent expectations as the most influential dimension of parent involvement (Jeynes, 2007). Effect sizes were large (Cohen, 1988, 1992) for parent expectations and overall student achievement ($g = .88$, $p < .0001$), grades ($g = .85$, $p < .0001$), and other forms of academic measurements ($g = 1.09$, $p < .0001$) for studies without sophisticated controls (Jeynes, 2007). No studies that employed sophisticated controls reported individual parent involvement practices. Additionally, there were no results for parent expectations and standardized tests, because reports that contained these variables were not employed within the meta-analysis.

The final investigation by Jeynes in his 2007 meta-analysis was to evaluate the impact of general parent involvement practices on the academic outcomes of minority students (2007). For this analysis, Jeynes divided the studies into two groupings, the first in which the studies contained mostly minority students in the sample, and the second in which the studies contained all minority students. As mentioned previously in this section, Jeynes labeled this an examination by race, but it may be more appropriate to call this an evaluation of the impact of parent involvement on minority students. The results of the analysis show that the impact of general parent involvement practices holds for studies in which the participants are mostly minorities ($g = .53$, $p < .05$) or all minorities ($g = .46$, $p < .001$), when evaluating the impact of such practices on overall academic measures. In studies with all minority students in the sample, medium to large effect sizes (Cohen, 1988, 1992) were produced for general parent involvement practices and grades ($g = .42$, $p < .0001$) and standardized testing ($g = .49$, $p < .001$). These findings, that the impact of parent involvement holds for minority students, is important to educational research and practice as schools and communities continue to seek methods to close the educational gap in our mostly minority inner-city schools.

Jeynes' work through the decade of the 2000s brought further clarity to the field of parent involvement research (Jeynes, 2003, 2005, 2007). Not only did Jeynes' work confirm Fan and Chen's finding (2001) that parent involvement has the greatest impact on overall academic achievement in students, but Jeynes found that this impact held in urban and minority communities. Further, the results discounted the findings of Mattingly and associates (2002), by presenting that within urban schools, parent involvement programs can indeed impact student learning and achievement.

Expectations and the Ecological Systems Theory

The stated focus of Fan and Chen's meta-analysis was to make sense of the impact of parent involvement on student outcomes through empirical studies. However, they noted that typologies and theories developed to support the need for parent involvement were not to be ignored within the parent involvement discussion (2001). In particular, Fan and Chen pointed toward the works of Epstein (1988a, 1988b) and Hoover-Dempsey and Sandler (1995), as foundational theories supporting high quality parent engagement. By establishing the importance of the theories and foundations above, Fan and Chen indirectly brought attention to the importance of Bronfenbrenner's theory of ecological systems (1979, 1986, 1992, 2005) when developing and analyzing dimensions of parent involvement.

The research of Fan and Chen (2001) and Jeynes (2003, 2005, 2007) suggests that parent expectations have the greatest impact on overall student outcomes. The ecological systems theory suggests that proximal processes advance human development (Bronfenbrenner, 1979, 1986, 1992, 2005) and that the interaction of these systems determine how a child or parent may develop. When examining how a parent's expectations are developed, it is difficult to do so without considering the impact that all the interactions, experiences, and relationships a parent has experienced within his or her lifetime have had on building overall expectations for the child, and how those expectations are communicated.

Previous research has discovered many different variables that influence the development of the processes that could impact the way a parent sets expectations for their children: parent education levels (Davis-Kean, 2005; Eccles & Davis-Kean, 2005; Eccles, Jacobs, & Harold, 1990), race (Carpenter, 2008; Davis-Kean, 2005; Seyfried & Chung, 2002), SES (Davis-Kean, 2005; Seyfried & Chung, 2002), teacher expectations (Benner & Mistry, 2007), student expectations and low student achievement (Zhang, Haddad, Torres, & Chen, 2011). Viewing these variables (such as race, education level, and SES) through the lens of ecological systems theory (Bronfenbrenner, 1979, 1986, 1992, 2005), it could be conjectured that their interactions greatly influence the level of expectations parents possess for their child's education. These variables work together to build social capital, which is critical for high-level interactions between the systems of development. For example, Eccles, Jacobs, and Harold (1990) contended that parent education levels had the greatest impact on parent expectations of their students' academic achievement, and Eccles and Davis-Kean pointed out that education levels of the parent could impact "parents' skills, values, and knowledge of the educational system, which, in turn should influence the educational practices at home" (p. 191, 2005). However, it can be argued through Bronfenbrenner's (1979, 1986, 1992, 2005) ecological systems theory, that all of the variables discussed in this review– parent education levels, race, SES, teacher expectations, student expectations and student achievement – play an important role in influencing, both good and bad, the level of expectations a parent holds for their children's academic achievement.

The Impact of Parent Expectations on Students' Academic Outcomes

The research of Fan and Chen (2001) and Jeynes (2003, 2005, 2007) confirmed what some have been arguing for decades; the effect of parent expectations on child development has been linked to positive outcomes (Entwisle & Baker, 1983; Entwisle & Hayduk, 1981). As parent involvement has received greater attention as a way to influence students' accomplishments in the classroom, a specific focus within the realm of parent involvement should be placed on the power of parent expectations. This greater focus on parent expectations should not be attributed only to previous research results such as those of Fan and Chen (2001), Jeynes (2003, 2005, 2007), Entwisle and Baker (1983), but also because parent expectations are a malleable variable that can be influenced throughout the academic lifetime of a student. Because parent expectations have great influence over student academic outcomes, and because the expectations parents hold are one of the dimensions of parent involvement that are malleable, the remainder of this paper will examine studies that follow the publication of Fan and Chen's meta-analysis in 2001, those that explore the relationship between parent expectations and students' academic outcomes. It is important to note that the focus on parent expectations in no way diminishes the importance of or impact on academic outcomes of the other indicators.

Positive Effect of Parent Expectations on Students' Academic Success

Many studies since Fan and Chen (2001) have found a positive relationship between parent expectations and academic outcomes (Davis-Kean, 2005; Froiland, Peterson, & Davidson, 2012; Hill & Tyson, 2009; Jacobs & Harvey, 2005; Phillipson & Phillipson, 2007; Seyfried & Chung, 2002; Zhang, Haddad, Torres, & Chen, 2011). Seyfried and Chung (2002) were interested in finding how parent expectations and teacher expectations interacted to predict student outcomes. In examining 567 African American and European American urban students, Seyfried and Chung distributed, collected, and analyzed parent and teacher surveys and inspected grade-point-averages, and discovered that parent expectations were a strong predictor of academic outcomes.

Like Seyfried and Chung (2002), Jacobs and Harvey (2005) examined the impact of parent expectations on predicting student success. Jacobs and Harvey found that there was a positive and significant correlation between parent expectations and success on the ENTER test, and that the length of time the parents had held those expectations mediated the association with the outcome of the test. The latter finding highlighted the importance of parents setting expectations for their children at an early age. However, Jacobs and Harvey also found – through the examination of a one-way ANOVA - that the higher-achieving schools had statistically significantly higher parent expectations and parents at the higher achieving schools placed a greater value on education than those at the medium and low performing schools. It is important to note that parents at the higher achieving schools had a significantly higher level of education than those at the medium and low performing schools. These findings appear to agree with Eccles and Davis-Kean's (2005) assertion that parent education levels are key in predicting parent expectations and student academic outcomes.

Expanding on the research of Jacobs and Harvey (2005), Froiland, Peterson, and Davidson (2012) investigated the long-term impact of parent expectations on student academic outcomes. By using the *National Center for Educational Statistics Early Child Longitudinal Study-Kindergarten Cohort (*West, Denton, & Germino-Hausken, 2000), they examined the impact of parent expectations in kindergarten on their students' academic outcomes in eighth grade. Froiland and associates found that parent expectations during a child's early years of development, namely in kindergarten, showed a significantly stronger correlation with longer lasting effect on the students' academic performance in eighth grade than did students' achievement in kindergarten ($r = 0.30$ correlation vs. $r = 0.15$).

Davis-Kean (2005), like Jacobs and Harvey (2005), examined education levels, socio-economic status (SES), and ethnicity of parents and how these variables impacted the association between parent expectations and student academic outcomes. Davis-Kean found that the "paths linking these variables (education, SES, and ethnicity) to children's academic achievement differed by racial group" (2005, p.302). These findings suggested that while parent expectations correlate strongly to student academic outcomes (r = 0.32 correlation) – regardless of race, SES and education levels – the route in which parents of differing races develop and set those expectations moderate the former relationship. This is an important fact for future researchers to take into consideration, as the study suggested that generalizations with regards to how parents formulate their expectations couldn't be applied generically across all races.

Further expanding the research on parent expectations, Benner and Mistry (2007) examined how parent and teacher expectations worked together to influence the academic outcomes of low-SES, urban students ages nine to sixteen. They found that independently, teachers' and parents' expectations had a significant association with students' academic outcomes. The study found that high mother expectations could combat the low expectations of teachers. This finding is critical for inner-city youth, as Benner and Mistry discovered that a high percentage of teachers in their study possessed low expectations for their students.

While the previously examined studies indicated how parent characteristics – race, ethnicity, income and education – could mediate or moderate the level of expectations parents hold for their students' academic outcomes, others sought to explore how student academic outcomes and student expectations mediate parent expectations. Zhang, Haddad, Torres, and Chen (2011), using data from the *National Educational Longitudinal Study of 1988* (NELS: 88) (Ingles, Scott, Taylor, Owings, & Quinn, 1998), discovered that there was a reciprocal effect, or mediation, between parent expectations and student expectations – meaning the higher the parent expectation, the higher the student expectation, and vice versa. Additionally, Zhang and associates established that there was also a mutual influence between parent and student expectations and students' academic outcomes. This finding supports previous literature that suggests that parent expectations impact student outcomes, but also suggests that parents and student expectations will be higher if the student is performing well in school. While this finding is positive for those students who are excelling in school, this reciprocal relationship could be a challenge to parent expectations, and in turn student academic improvement, for those students who are struggling in the classroom. Within their study, Froiland, Peterson, and Davidson (2012) built upon the findings for Zhang and colleagues (2011) by again demonstrating the reciprocal nature of student and parent expectations, and that student expectations can also be used to predict academic success.

This section has analyzed quantitative studies that examined the impact of parent expectations on students' academic outcomes. The findings show that parent expectations can have a direct relationship to academic outcomes (Davis-Kean, 2005; Froiland, Peterson, & Davidson, 2012; Jacobs & Harvey, 2005; Seyfried & Chung, 2002; Zhang, Haddad, Torres, & Chen, 2011), can be mediated by income levels, education levels, (Davis-Kean, 2005) and participation in other parent involvement practices, and can be moderated through race and ethnicity (Davis-Kean, 2005; Seyfried & Chung, 2002; Zhang, Haddad, Torres, & Chen, 2011). Additionally, it was discovered that parent expectations could be predicted through student expectations, and vice versa (Froiland, Peterson, and Davidson, 2012; Zhang, Haddad, Torres, & Chen, 2011).

Variables Impacting the Relationship Between Parent Expectations and Students' Academic Success

While the research studies previously examined in this paper have found a positive relationship between parent expectations and student outcomes, other research has shown a much smaller or no statistically significant effect of expectations on academic outcomes. These conflicting results seemingly are a product of differing methodologies. Within this section those differences, such as income level, race, and ethnicity, are examined to determine the influence these variables have on the overall bearing of parent expectations on students' academic achievement. These divergent results, due to the variables stated above, would lend credence to the importance of the considerations of Bronfenbrenner's theory when gauging the impact of parent involvement on student outcomes.

Citing that previous studies failed to investigate the impact expectations had on Latino students of immigrant parents, the fastest growing population in American schools, Carpenter (2008) chose to investigate how immigrant parents' expectations predicted the academic outcomes of their children. He found that there were no statistically significant effects of parent expectations on student outcomes for students who had at least one immigrant parent. His findings did indicate that previous academic success and hours spent on homework did predict math scores. The importance of his findings may indicate that students of immigrant parents rely less on parent expectations and motivation, and more on their own drive and academic ability than their counterparts.

Some studies that showed positive relationships between parent expectations and academic outcomes also had findings that showed limited impact of parent expectations when mediated or moderated by education level (Benner & Mistry, 2007; Englund, Luckner, Whaley, & Egeland, 2004), socio-economic status (SES), or ethnicity (Davis-Kean, 2005; Seyfried & Chung, 2002; Yan & Lin, 2005; Zhang, Haddad, Torres, & Chen, 2011). In a longitudinal study, Englund, Luckner, Whaley, and Egeland (2004) found that the level of education attained by the mother strongly predicted her expectations level for her child when entering first grade. Benner and Mistry (2007) established that a mother's expectations of achievement for her 5th grade student did impact academic outcomes. However, they found that the lower the education level of the mother, the less influence the mother's expectations had on student achievement.

Through an examination of urban 8th graders, Seyfried and Chung (2002) found that higher parent expectations predicted higher grade point averages in students, but the effect was much greater for European American students than it was for African-American students. In a similar study, but one that investigated how student academic expectations correlated strongly to parent expectations, Zhang, Haddad, Torres, and Chen (2011) found that the relationship between students' academic expectations and parent expectations was weakest for African American students. Wood, Kaplan, and McLoyd (2007) also found that within low-income schools the expectations of students, teachers, and parents of students' academic achievement were lower for African-American students than for any other ethnicity. Additionally, they discovered that the level of expectations a teacher had for her students could impact the student's own expectations in African-American students. Davis-Kean (2005) established that the strength of association between parent expectations and reading achievement diminished the lower the education level of the parent. Additionally, she found that ethnicity and income levels impacted the strength of relationship between expectations and academic outcomes. Contrary to the finding of Davis-Kean, Seyfried and Chung, and Wood, Kaplan, and McLoyd, Yan and Lin (2005) discovered that parent expectations were the greatest predictor of math achievement for seniors in high school. The data examined by Yan and Lin was from the National Education Longitudinal Study: 1988 (NELS:88) dataset. These results illustrate that the effect of parent education level, SES, and ethnicity varies when investigating the relationship between parent expectations and academic outcomes of students. The findings indicate that parent education level, SES, and ethnicity need to be considered more deeply in future studies.

The Argument for Understanding Parent Expectations through Qualitative Research

Some of the research previously explored in this paper found that parental expectations have less impact in low SES or ethnic minority communities (Davis-Kean, 2005; Seyfried & Chung, 2002; Zhang, Haddad, Torres, & Chen, 2011). To explore this phenomenon further, recent qualitative work within low SES, ethnically diverse communities was investigated. For example, in contrast to a qualitative study by Carpenter (2008) that found no significant association between the expectations of parents and their child's academic outcome, Lopez, Scribner, and Mahitivanichcha (2001) investigated a single Latino migrant family to determine how parent involvement impacted their children's learning and academic accomplishments. They found that outside of the normally accepted parent involvement practices that encourage parents to be present on campus, study participants influenced their children's learning through expectations. What is seemingly different in the approach of Lopez and colleagues, compared to Carpenter, is that other than the qualitative nature of the study, the participants of the study turned their academic expectations for their children into a choice that their children could make – do well in school and go to college or be subjected to a life of hard labor, such as the parents were currently living. The parents instilled the value of education, and a strong work ethic, by making all the children labor in the fields with the parents for a couple of weeks each summer. Lopez's team surmises that the participants' children performed well in high school – all five graduated in the top ten percent of their class – because the parents not only set an expectation of graduating high school and going to college but provided the children with a glimpse of what could happen should the children not be successful in the classroom.

Other researchers found that parents of ethnic minorities, and Latinos in particular, felt as though their influence on their child's education was discounted or ignored altogether by teachers and administrators (Carreón, Drake, & Barton, 2005; Perreira, Chapman, & Stein, 2006; Ramirez, 2003; Smith, Stern, & Shatrova, 2008; Souto-Manning & Swick, 2006). This practice by teachers and administrators, while at times unintentional, shuts down school-to-home partnerships, limiting the visible parent involvement practices that are considered by many to be the norm (Smith, Stern, & Shatrova, 2008). However, this does not mean that parent involvement practices cease to exist in these families, and that parents begin to care less about learning. Smith, Stern, and Shatrova (2008) established that parents who feel that they are disregarded by school personnel retreat from the school campus but still maintain the expectations that were set prior to interactions with the school. These parents maintain that it is their role to continue to instill respect for teachers, assist and monitor homework, and get their children prepared for school. While expectations, in these cases, are not always verbally communicated, value in education is communicated through the parents' (normally the mothers') constant involvement in school matters at home.

These studies reveal that expectations are present whether they are clearly communicated to school personnel. Carreón, Drake, and Barton (2005) noted that even though the parents in their study felt disrespected by schools due to their limited English proficiency and lack of education, the parents did not let that affect the high expectations the parents possessed for their children's academic success. While this study and the others discussed in the qualitative section of this paper cannot be generalized, the information is beneficial in helping to understand perceptions and practices of minority families and how this information can guide future research and interactions with school personnel.

Rationale for Present Study

Researchers such as Fan and Chen (1999) have investigated the impact of parent expectations and the effect they have on students' academic success. Fan and Chen's meta-analysis revealed that of all forms of parent involvement, parent expectations of student academic performance had the greatest impact on a student's overall academic success. Recent studies by Wang and Benner (2014) and McNeal (2014) built upon this discovery by examining the phenomenon of parent expectations through an ecological lens – areas of the student's environment - as defined by the work of Bronfenbrenner (1979, 1986, 1992, 2005). The ecological system consists of five interconnected layers– the microsystem, the exosystem, the mesosystem, the macrosystem, and the chronosystem. The microsystem is the child's most immediate setting and consists of direct interactions between the child and others, such as parents and siblings. The next level, the mesosystem is defined by interactions between persons within the child's microsystem when the child is not present (i.e., parent and teacher conferences). The exosystem consists of events within the microsystem such as a parent losing a job or moving from one city to another. The macrosystem is the layer of the ecosystem where religion and culture reside. The macrosystem is made up of all regularly observed practices, cultures, sub-cultures, ideologies and belief systems that reside in any of the previously mentioned layers. The impact that time has on the overall ecological system of a child is called the chronosystem – such as the increasing financial burdens of a job loss and how those burdens and affects are impacting over time. Although Wang and Benner (2014) and McNeal (2014) employed differing methodologies of incorporating a student's ecosystem into the evaluation of the impact of parent expectations (an environmental variable within a student's microsystem), both studies recognized the critical nature of a student's surroundings and how those contexts may influence the impact of parent expectations on academic achievement.

Using the National Education Longitudinal Study of 1988 (NELS:88) data set, Wang and Benner (2014) treated the impact of parent expectations in a more sophisticated way than previous researchers by examining how the discrepancy between adolescent (Grade 8) and parent expectations of academic success, both actual and perceived, influenced academic achievement – GPA, standardized test scores, and a student's expectations of future educational attainment. Other environmental factors including the role that gender and race played in moderating the relationship between expectations and academic success were also assessed, but there were no statistically significant differences found between genders or between races within their study.

Wang and Benner (2014) found that as a parent's actual (i.e., self-reported) expectations exceed her student's expectations, the student's academic achievement, in the form of standardized test scores would rise. Additionally, Wang and Benner found that as a student's perceived parental expectations of academic success exceeded the student's own expectations, academic performance would fall. The first result could be understandable, when parents have a higher expectation for their child's academic success then the child does, it is easy to imagine that those parents are highly involved in the student's academic life in ways such as setting academic goals, checking in on the student's progress, assisting with homework, and setting designated study times and locations (Davis-Kean, 2005).

Not as simple to unravel is why a student's academic performance would suffer if her expectations of academic success were lower than how she perceives her parents' expectations. It could be that even though the student perceives parent expectations to be high, the support from the parents is not present, therefore parental impact is limited. Conversely, a student perceiving that her parent has higher expectations than she possesses could cause her undue stress (Agliata & Renk, 2008; Wang & Benner, 2014). Trying to please her parents, while not believing she has the ability to achieve her parent's lofty goals could have damaging effects.

Wang & Benner (2014) touched the surface of a student's ecological system, more specifically the mesosystem (Bronfenbrenner; 1979, 1986, 1992, 2005), by evaluating the relationship of differences in student and parent expectations and how those differences impacted overall academic achievement. McNeal (2014), however, took a more demographically nuanced looked into a student's environment by reviewing how, nested within schools, a student's parent's background (socioeconomic status as defined by both parent's occupations, education, and overall family income), a parent's interaction with her student (such as a child's frequency of discussing high-school programs, class content, and school activities with both parents), and a parent's involvement in PTO impacted academic achievement - results on standardized test scores. By addressing these variables, McNeal's study considered systems not only within the microsystem, but the mesosystem and exosystem (Bronfenbrenner; 1979, 1986, 1992, 2005) of the child. Each child's school environment was specifically defined by two variables; the level of poverty of the school, defined by percentage of students on free and reduced lunch, and instability within a school which was defined by percentage of students that started and finished the school year.

McNeal (2014) found that parent-child discussion significantly positively impacted mathematics, science, and reading achievement. It was also discovered that parent-child discussion, as well as parent involvement in PTO significantly increased a student's own expectations of academic attainment – how far they will go in school. Social context – SES – was found to moderate the individual level effects of parent-child discussion and parent involvement in PTO on a student's own expectations of academic attainment. Additionally, school effects such as concentration of poverty and school stability were also found to significantly moderate the impact parent-child discussion and parent involvement in PTO had on a student's own expectations of academic attainment and achievement in mathematics, science and reading.

An increase in academic achievement – science, reading, and math – due to an increase in parent-child discussion can be explained through the understanding that the more a parent is directly involved in academic discussions with her child, the more likely it is for the student to be engaged in her school work, and more likely to get the most out of her academic potential. Similarly, as a parent is more involved in both direct discussion with her child and more involved in the school through PTO, a student is more likely to have higher expectations of not only doing well in school, but a greater expectation to go on to college from high school. The moderating effects of SES, defined by parent education and employment, could be viewed as the more experience a parent has with higher education, the more likely her involvement with the child's schoolwork and school activities will be related to the child's academic expectations. Similarly, the better the job, the more resources a parent would have (such as sending a student to private tutors and SAT preparation courses), therefore, the more likely parent involvement will impact the child's expectations.

McNeal (2014) expanded upon the work of Wang and Benner (2014) by taking a deeper look into the impact of a student' environment on a student's academic success and a student's own expectations of academic achievement by incorporating a multilevel model that among other things, considered school-level variables such as a school's poverty concentration. While the findings from this study were significant, and important to the overall portfolio of research on the impact of parent involvement, McNeal used parent activities with students and within the student's school but omitted the use of parent expectations – found by Fan and Chen (1999) to be the most influential form of parent involvement – from his work. Therefore, for the current study, I choose to build upon the efforts of Wang and Benner's (2014) study by continuing the examination of the impact of discrepancies between student and parent expectations in the presence of individual student expectation on the academic achievement and future expectations of academic achievement of students while incorporating a multilevel model similar to that used by McNeal (2014).

This study proposes to expand upon the work of Wang and Benner (2014) by closely replicating the nesting modeled by McNeal (2014) to investigate the phenomenon of parent expectations through the lens of Bronfenbrenner's (1979, 1986, 1992, 2005) theory of bioecological systems. Using a multilevel model to examine the relationship between both student expectations and parent and student discrepancies in expectations and academic outcomes (test scores and a student's future expectations of academic attainment) nested within schools, this study will examine how the school-level variable of school poverty moderates the aforementioned relationships. Additionally, the interactions of student expectations and discrepancies in parent and student expectations will be investigated.

Summary of the Literature Review

Parent involvement has been at the forefront of school revitalizations for the last few decades. As budgets continue to shrink, cost-effective ways to increase student achievement will continue to grow, particularly in urban, low-income schools. Fan and Chen (2001) examined the bearing that five differing parent involvement indicators had on the academic outcomes of students. Through the work of Fan and Chen and the other literature reviewed in this paper, one clearly sees that parent expectations are a large part of the parent involvement equation. As one dimension of the complex area of parent involvement, parent expectations have been shown to strongly predict student's academic outcomes (Davis-Kean, 2005; Fan & Chen, 2001; Froiland, Peterson, & Davidson, 2012; Hill & Tyson, 2009; Jeynes, 2003, 2005, 2007; Seyfried & Chung, 2002; Wang & Benner, 2014; Zhang, Haddad, Torres, & Chen, 2011). However, these expectations are impacted by each parent's interaction with many social systems, both present and past (Bronfenbrenner, 1979, 1986, 1992, 2005). Grounded in Bronfenbrenner's ecological systems theory, it is not difficult to understand why parent expectations are stimulated by the many social interactions affecting each student, such as teacher expectations (Benner & Mistry, 2007), parent education levels (Eccles, Jacobs, & Harold, 1990; Englund, Luckner, Whaley, & Egeland, 2004; Davis-Kean, 2005; Eccles & Davis-Kean, 2005), race (Carpenter, 2008; Davis-Kean, 2005; Seyfried & Chung, 2002), SES (Davis-Kean, 2005; Seyfried & Chung, 2002), and student achievement (Zhang, Haddad, Torres, & Chen, 2011). It is recommended that future research examine both the individual and combined influence of parent, teacher, and students' expectations on academic achievement, how those variables are mediated by income levels and parents' education achievement, and how levels of expectation are moderated by race and ethnicity.

Chapter 3: Research Methods

This chapter will explore the research methods and rationale behind the methods I used in this study. Specifically, within this chapter, research questions, hypotheses of the researcher, variables, statistical models, and threats to validity and reliability are examined. For purposes of simplicity, I will use acronyms when referring to discrepancies in parent-student expectations. The designations are below:

DIS_ACTEX: Discrepancies between actual parent and student expectations of academic attainment. In other words, discrepancies between parents' actual (i.e., self-reported) expectations for their students' academic attainment, and the students' own self-reported expectations. These expectations were reported in a NELS:88 survey taken when the student was in 8^{th} grade. A positive score in this category indicates that the parent held a higher expectation of academic attainment then her student. A negative score indicates that the student held a higher level of expectation.

DIS_PEREX: Discrepancies between perceived parent expectations and student expectations of academic attainment. Discrepancies between what students perceive to be their parents' expectations for their academic attainment, and their own expectations for academic attainment. These expectations were reported in a NELS:88 survey taken when the student was in 8^{th} grade. A positive score in this category indicates that the student perceived her parent to have a higher expectation of academic attainment then the student herself held. A negative score means that the student held a higher level of expectation then she perceived her parent to have.

Research Questions

The two outcomes explored in this study were standardized test scores and a student's future expectations of overall academic attainment – how far will they go in school. Deepening the research of Wang and Benner (2014), this researcher sought to examine the discrepancies in expectations through the lens of Bronfenbrenner's ecological systems theory (1979, 1986, 1992, 2005) by using a multi-level model to consider how a student's school environment impacted the relationship between discrepancies in the academic expectations of parents and adolescents and academic outcomes such as standardized test scores and a student's future expectations of overall academic attainment. Statistical modeling similar to McNeal's (2014) research, which employed a multi-level model to investigate how parent-child interactions and parent PTO impact academic outcomes, will be evaluated by adding the predictor variables of discrepancies in parent-student expectations, as defined by Wang and Benner in their 2014 study, and the outcome variable of a students' expectation of academic attainment. This study will utilize McNeal's model with a selection of variables close to that employed by Wang and Benner (2014). However, unlike either McNeal or Wang and Benner, the interaction of student expectation and discrepancies in parent and student expectations will be evaluated in the full statistical model.

Using ordinary least squares regression, Wang and Benner (2014) found that discrepancies between parent – perceived and actual – and student expectations of academic achievement had an impact on standardized test scores. However, the study failed to account for possible variance between schools, and the possibility of how differences in schools could affect the impact of their results. This research expands upon the work of Wang and Benner (2014) and McNeal (2014) by using a multilevel model to investigate the impact of discrepancies in parent and student expectations on standardized test scores and a student's long-term expectations of academic achievement while incorporating school-level variables such as school poverty levels.

The constructed variables of parent participation in PTO and parent-child discussion employed by McNeal (2014) were considered for the present research. However, the current study wanted to incorporate school level variables to determine what impact, if any, levels within Bronfenbrenner's (1979, 1986, 1992, 2005) ecological systems theory the mesosystem (connection between home and school) and exosystem (external influences on schools) had on the relationship between differences in expectations and academic outcomes. The research questions for the current study were:

Q1. Do student expectations predict academic outcomes such as results on standardized tests and expectations of future academic attainment?

Q2. Is there a relationship between DIS_ACTEX and student performance on standardized tests?

Q3. Is there a relationship between DIS_PEREX and student performance on standardized tests?

Q4. Is the relationship between DIS_ACTEX and student's score on standardized tests moderated by a school's poverty level?

Q5. Is the relationship between DIS_PEREX and student's score on standardized tests moderated by a school's poverty level?

Q6. Is the relationship between DIS_ACTEX and student's long-term expectations of academic attainment moderated by a school's poverty level?

Q7. Is the relationship between DIS_PEREX and student's long-term expectations of academic attainment moderated by a school's poverty level?

Q8. Does the impact of discrepancies in expectations (actual and perceived) vary by school?

Hypotheses

As mentioned previously, Wang and Benner (2014) found that as a parent's actual expectations exceed her student's expectations, the student's academic achievement would rise.

Additionally, as a student's perceived parental expectations of academic success exceeded the student's own expectations, academic performance would fall. This study seeks to evaluate the impact both student expectations and the difference in parent and student expectations have on academic outcomes using a multilevel model with students nested in schools.

H1. A student's expectation of academic attainment will positively impact academic outcomes.

As a student holds a higher expectation for her academic attainment – how far will she go in school – her belief in herself will assist in her overall academic achievement. Test scores would be expected to increase owing to her self-belief and corresponding effort to reach her goal.

H2. Discrepancies in actual expectations will have a positive impact on a student's standardized test scores.

Similar to the findings of Wang and Benner (2014), my expectations are that as a parent's expectations exceed her child's expectations, the student's scores on standardized testing will increase. Conversely, if a student's expectations exceed those of her parent's, then the student's standardized test score would be expected to decrease. The rationale behind this assessment, beyond the findings of Wang and Benner, is that parents who hold high expectations for their students would be expected to participate in a student's academic life at a higher level than parents who hold lower expectations.

H3. Discrepancies in perceived expectations will have a negative impact on a student's standardized test scores.

The rationale here, comparable to Wang and Benner's finding, is that as a student perceives her parent to have higher expectations than her own, the student's test scores would suffer. One could envision that the added pressure of the student to do well in school without the support of her parent could cause a student to struggle in school.

H4. School poverty will moderate the relationship between DIS_ACTEX and standardized test scores in all subjects.

Hypothesis four implies that if a school has a high concentration of students on reduced and free lunches (greater than 50%) the relationship between DIS_ACTEX and test scores will be greater than that for students attending schools that do not have a high concentration of students on free and reduced lunches. For example, if a student has much higher expectations than her parents' actual expectations an impoverished school will not have the academic support resources necessary to support the student's ambitions in the same way a school that is not impoverished would be able to offer academic support to the same student. It is hypothesized that in this scenario the student's test scores would suffer more than a student who attends a school that is not considered high-poverty.

H5. School poverty will moderate the relationship between DIS_PEREX and standardized test scores in all subjects.

Like the previous hypothesis, if a student possesses a perception that her mom has higher expectations than her own expectations, the student could suffer from both a lack of emotional and academic support from her mother. If the student attends a high-poverty school, the discrepancy might exacerbate the lack of support compared to a student attending a school that was not considered high-poverty. A school with limited resources may not be able support the student's progress to the same extent as a more affluent school, thus the relationship between DIS_PEREX and standardized test scores will be stronger in poorer schools.

H6. School poverty will moderate the relationship between DIS_ACTEX and a student's future expectations of academic achievement.

H7. School poverty will moderate the relationship between DIS_PEREX and a student's future expectations of academic achievement.

Conclusions drawn for hypotheses four and five are like those drawn for the first two hypotheses. That is, if a school is considered to have a high concentration of students on reduced and free lunches, the impact of differences between expectations on long-term expectations of academic achievement will be greater. A student who attends an impoverished school and possesses a much higher expectation than her parents (actual or perceived) may not have the resources necessary to support the student's ambitions in the same way that a student would at a more affluent school.

H8. The relationship between discrepancies in expectations – both perceived and actual – and student outcomes (standardized test scores and future expectations of academic attainment) will vary by school.

This hypothesis states that the impact of differences in student and parent expectations will differ by school. One example would be that some schools may have programs to assist both parents and students as they prepare for life after high school – college prep classes such as Education Opens Doors. These programs, in addition to high parent expectations, could work to strengthen a student's future expectations of academic attainment. For students who attend schools without such programs, no such impact would be garnered.

Participants and Variables

Data Set. The data set chosen for this study came from the National Education Longitudinal Study of 1988 (NELS:88). NELS:88 was selected for several reasons. First, the data was collected for a large sample size at the student, parent, and school level allowing for a nested model with large sample sizes. Next the data collected asked questions of both students and parents about expectations of academic achievement over multiple years allowing the researcher to evaluate the long-term impact of parent expectations. Most importantly, because my study is expanding upon the work of Wang and Benner (2014) using a nested model like McNeal (2014), it was important to me to use the data set from the same study in my research.

Population. The participants for the present study included students who were in Grade 8 and participated in the first four years of the NELS:88, through Grade 12. A total of four different subsets of the NELS:88 data sets were used within this study. Each outcome variable had two separate data sets, one to evaluate the impact of DIS_ACTEX and another to evaluate the impact of DIS_PEREX. To be included in a specific data set a student must have (1) had a score for the specific outcome variable designated in the data set, (2) an answer to item BYS45 on the base-year student survey, and (3) either have a parent complete a base-year parent survey answering item BYP76 (participation in the DIS_ACTEX evaluation) or the student had answered item BYS48A or BYS48B (participation in the DIS_PEREX evaluation) on the base-year student survey. For each specific measurement the participant breakdown was as follows:

Test Scores. There were 10,643 participants nested in 944 schools when examining the impact of perceived discrepancies on results of a Grade 12 standardized science test. The sample size was 11,710 students nested in 945 schools when examining the impact of actual discrepancies.

Future Expectations of Academic Achievement. There were 11,859 participants nested in 955 schools when examining the impact of perceived discrepancies on a student's future expectations of academic achievement. The sample size was 12,954 students nested in 959 schools when examining the impact of actual discrepancies.

Predictor Variables

The first set of predictor variables examined in this study were discrepancies in parent- and student expectations of academic attainment calculated using responses gathered from students' and parents' self-reported answers on the NELS:88 Base Year Student Survey and mirror the variables used by Wang and Benner (2014). The variables used were student expectations, student's perception of parent expectations, actual (i.e., self-reported) parent expectations, discrepancy between actual parent expectations and student expectations, discrepancy between perception of parent expectations and student expectations, the interaction of student expectations and discrepancy between actual parent expectations and student expectations, and the interaction of student expectations and discrepancy between perception of parent expectations and student expectations. The section below details how each these variables are defined and how differences were calculated within this study.

Student expectations of academic attainment. Students' expectations, a level-one variable, was operationally defined using an item from the NELS:88 Base-Year Student Surveys. The student question was, "as things stand now, how far in school do you think you will get?" An ordinal scale, ranging from 0 – "less than high school" to 4 – "beyond bachelors", was used to evaluate responses of the students. The original scale of the NELS:88 was 1 to 6 but modified to a scale of 0 to 4 to mirror the methods used by Wang and Benner (2014). Like Wang and Benner, attendance in a vocational or 2-year school and some college were combined into one level – attend some school after high school - in order to achieve the same scale of 0 to 4.

Student's perceived parent expectations of student's academic attainment. Like student expectations, the level-one variable of student's perception of parent expectations was operationally defined using an item from the NELS:88 Base-Year Student Surveys - items BYS48A and BYS49B. The student question was, "how far in school do you think your parents think you will get?" An ordinal scale, ranging from 0 – "less than high school" to 4 – "beyond bachelors", was used to evaluate responses of the students. The original scale of the NELS:88 was 1 to 6 but was modified to a scale of 0 to 4 to mirror the methods used by Wang and Benner

(2014). Like Wang and Benner, attendance in a vocational or 2-year school and some college were combined into one level in order to achieve the scale of 0 to 4.

Parent's actual expectations of her student's academic attainment. Mimicking the question posed to the students - item BYP76 on the NELS:88- the parent survey item asked participants, "how far in school do you want your student to go?" The same ordinal scale used by the students was employed on the parent survey. A scale ranging from 0 – "less than high school" to 4 – "beyond bachelors", was used to evaluate parent responses. The original scale of the NELS:88 was 1 to 10 but was modified to a scale of 0 to 4 by collapsing answers into similar categories, to mirror the methods used by Wang and Benner (2014).

Discrepancy of parent and student expectations of a student's academic attainment - actual. The level-one variable of discrepancy between student's expectation of academic attainment and her parent's actual expectations of the student's academic attainment – DIS_ACTEX – was operationally defined as a calculated result of subtracting a student's expectations (BYS45) from the parent's actual expectations (BYP76). Since the scales were identical for parent and student, a positive number would indicate that the parent had reported a higher expectation than the student. If the number was negative, the student's expectation of academic attainment would be higher than that of the parent. Scores of zero meant that student's view and her parent had reported identical expectations for the student's academic attainment.

Discrepancy of parent and student expectations of a student's academic attainment - perceived. Another level-one variable, the discrepancy between student's expectation of academic attainment and her perception of her parent's expectations of her academic attainment - DIS_PEREX - was operationally defined as a calculated result of subtracting her perceived view of her parent's expectations (BYS48A and BYS48B) from the student's own expectations (BYS45). Since the scales were identical for perceived expectations and student expectations, a positive number would indicate that the assumed parent expectation was higher than the student's expectation of academic attainment. If the number was negative, the student's expectation of academic attainment was higher than her perceived parental expectations. Scores of zero meant that student and her perceived view of her parent's expectations were identical.

The interaction of student expectations of academic attainment and discrepancy of parent and student expectations of a student's academic attainment - actual. A level-one variable, the interaction between student expectations and discrepancy in actual expectations, was created using the previously defined variables of student expectations of academic achievement and discrepancies of parent and student expectations of a student's academic achievement - actual.

The interaction of student expectations of academic attainment and discrepancy of parent and student expectations of a student's academic attainment - perceived. A level-one variable, the interaction between student expectations and discrepancy in perceived expectations, was created using the previously defined variables of student expectations of academic achievement and discrepancies of parent and student expectations of a student's academic achievement - perceived.

Moderating Variable

To better understand how multiple levels of societal layers impact a student's academic outcomes, this study focused on a multilevel model of students nested within schools. While mirroring the use of school poverty levels by McNeal (2014), the current study examined the moderating effect of poverty on the relationship between both DIS_ACTEX and DIS_PEREX and academic outcomes – standardized test scores and a student's future expectations of academic achievement. School poverty levels are defined below.

School poverty level. School poverty was defined as a dichotomous variable calculated by taking the school level variable G8LUNCH from NELS:88 Base-Year School Survey. If a school had more than 50% its students receiving reduced or free lunches, then it was determined to be a poverty concentrated school (McNeal; 2014) and was noted by a 1. All other schools were deemed to be not poverty concentrated schools and were coded with a 0.

Outcome Variables

The outcome variables that were used in this study were like those studied by Wang and Benner (2014) and McNeal (2014). The operational definition of achievement tests differs from Wang and Benner (2014), but mirrored McNeal (2014) as the present study did not solely evaluate student outcomes based on an average of math and reading achievement test scores. Instead this study used a combination of all four individual test scores – science, math, history, and reading – to evaluate over all academic success. The achievement score definition is described in the section below.

Test Scores. Testing used in the NELS:88 study was developed by Education Testing Service (ETS). During Grade 12 tests were administered to each student. The present study evaluated students' outcomes of the number of correct responses on the ETS math, reading, science, and history tests and additively combined all four into one variable, test scores. To be included in the study, a student must have completed and have a score reported for a test in each of the four subjects. Due to each standardized test having a different number of total items for students to answer, actual ranges for each individual test varied – history (20.72 to 45.38 correct responses), math (16.77 to 78.10 correct responses), reading (10.41 to 50.89 correct responses), and science (10.03 to 35.96 correct responses). The implications of adding scores on differently-scaled tests to create a single composite score are addressed in the Discussion section.

Student's future expectations of academic achievement. A student's self-reported answer on the NELS:88 Fourth-Year Follow-Up Student Survey to the question "what are your educational aspirations by the age of 30" was used to determine long-term expectations of academic achievement. Student responses ranged from (1) "earn a GED or high school certificate" to (10) "MD, LLB, JD, DDS or equivalent".

Statistical Models

The current study investigated how student expectations and discrepancies between parent and student expectations impacted standardized test scores and a student's future expectations of academic attainment, and how these relationships were moderated by a school's level of poverty concentration. These relationships were evaluated using four multilevel models to examine both outcome variables – test scores and a student's future expectations of academic attainment – predicted by both actual and perceived discrepancies in expectations of academic attainment. The full models, the formulas for each of the statistical analyses, and description of notations are detailed in the information below.

Full hierarchical linear model:

Level 1

$$y_{ij} = \beta_{0j} + \beta_{1j}x_{1ij} + \beta_{2j}x_{2ij} + \beta_{1j}(x_1x_2)_{ij} + \epsilon_{ij}$$

Level 2

$$\beta_{0j} = \gamma_{00} + \gamma_{01}w_{1j} + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}w_{1j} + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}w_{1j}$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31}w_{1j}$$

Formulas and notation for each specified hierarchical linear model (DIS_ACTEX):

TestScores$_{ij}$ = $\beta_{0j} + \beta_{1j}DISACTEX_{ij} + \beta_{2j}Student\ Expectations\ _{ij} + \beta_{1j}(DISACTEX * Student\ Expectations)_{ij} + \epsilon_{ij}$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}School\ Poverty_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}School\ Poverty_j + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}School\ Poverty_j$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31}School\ Poverty_j$$

FutureEx$_i$ = $\beta_{0j} + \beta_{1j}DISACTEX_{ij} + \beta_{2j}Student\ Expectations\ _{ij} + \beta_{1j}(DISACTEX * Student\ Expectations)_{ij} + \epsilon_{ij}$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}School\ Poverty_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}School\ Poverty_j + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}School\ Poverty_j$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31}School\ Poverty_j$$

TestScores$_{ij}$ = outcome variable represented by the expected number of correct responses on a combination of standardized tests (history, math, reading, and science) administered in Grade 12 for the *i*th student unit nested in the *j*th school.

FutureEx$_{ij}$ = outcome variable represented by the expected score for future expectations of educational attainment for the *i*th student nested in the *j*th school.

γ_{00} = overall intercept for the fixed effect model if student expectations and actual discrepancies in parent expectations are 0, and the school attended is not considered to be high-poverty.

γ_{01} = overall mean level-2 intercept or the expected change in the dependent variable (test scores and future expectations) for students attending the *j*th school if the student attends a high-poverty school.

γ_{10} = overall level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change in actual discrepancies (centered on the mean) for the *i*th student attending the *j*th school.

γ_{11} = overall mean level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change from the interaction between school poverty and actual discrepancies (centered on the mean) for the *i*th student attending the *j*th school.

γ_{20} = overall level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change in student expectations (centered on the mean) for the *i*th student attending the *j*th school.

γ_{21} = overall mean level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change from the interaction between school poverty and student expectations (centered on the mean) for the *i*th student attending the *j*th school.

γ_{30} = overall level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change of the interaction between student expectations (centered on the mean) and actual discrepancies (centered on the mean) for the *i*th student attending the *j*th school.

γ_{31} = overall mean level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change from the interaction between school poverty, student expectations (centered on the mean) and actual discrepancies (centered on the mean) for the *i*th student attending the *j*th school.

Student Expectations$_{ij}$ = self-reported level of expectations of academic achievement for student *i* attending school j

DIS_ACTEX$_{ij}$ = actual discrepancies in parent and student expectations for student *i* attending school j.

School Poverty$_j$ = school concentration of poverty (0 <= 50% of students on free and reduced lunches; 1 = >50% of students on free and reduced lunches) for students attending school *j*.

u_{0j} = random effects of the *j*th school unit on the intercept.

u_{1j} = random effects of the jth level-2 unit adjusted for actual discrepancies in parent and student expectations on the slope.

ϵ_{ij} = random error associated with student *i* in school *j*.

Formulas and notation for each specified hierarchical linear model (DIS_PEREX):

TestScores$_{ij}$ = $\beta_{0j} + \beta_{1j}DISPEREX_{ij} + \beta_{2j}Student\ Expectations\ _{ij} + \beta_{1j}(DISPEREX * Student\ Expectations)_{ij} + \epsilon_{ij}$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}School\ Poverty_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}School\ Poverty_j + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}School\ Poverty_j$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31}School\ Poverty_j$$

FutureEx$_i$ = $\beta_{0j} + \beta_{1j}DISPEREX_{ij} + \beta_{2j}Student\ Expectations\ _{ij} + \beta_{1j}(DISPEREX * Student\ Expectations)_{ij} + \epsilon_{ij}$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}School\ Poverty_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11} School\ Poverty_j + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21} School\ Poverty_j$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31} School\ Poverty_j$$

TestScores$_{ij}$ = outcome variable represented by the expected number of correct responses on a combination of standardized tests (history, math, reading, and science) administered in Grade 12 for the *i*th student unit nested in the *j*th school.

FutureEx$_{ij}$ = outcome variable represented by the expected score for future expectations of educational attainment for the *i*th student nested in the *j*th school.

γ_{00} = overall intercept for the fixed effect model if student expectations and discrepancies in perceived parent expectations are 0, and the school attended is not considered to be high-poverty.

γ_{01} = overall mean level-2 intercept or the expected change in the dependent variable (test scores and future expectations) for students attending the *j*th school if the student attends a high-poverty school.

γ_{10} = overall level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change in perceived discrepancies (centered on the mean) for the *i*th student attending the *j*th school.

γ_{11} = overall mean level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change from the interaction between school poverty and perceived discrepancies (centered on the mean) for the *i*th student attending the *j*th school.

γ_{20} = overall level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change in student expectations (centered on the mean) for the *i*th student attending the *j*th school.

γ_{21} = overall mean level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change from the interaction between school poverty and student expectations (centered on the mean) for the *i*th student attending the *j*th school.

γ_{30} = overall level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change of the interaction between student expectations (centered on the mean) and perceived discrepancies (centered on the mean) for the *i*th student attending the *j*th school.

γ_{31} = overall mean level-2 slope or the expected change in the dependent variable (test scores and future expectations) for every 1 unit of change from the interaction between school poverty, student expectations (centered on the mean) and perceived discrepancies (centered on the mean) for the *i*th student attending the *j*th school.

Student Expectations$_{ij}$ = self-reported level of expectations of academic achievement (centered on the mean) for student *i* attending school j

DIS_PEREX$_{ij}$ = perceived discrepancies in parent and student expectations (centered on the mean) for student *i* attending school j.

School Poverty$_j$ = school concentration of poverty (0 <= 50% of students on free and reduced lunches; 1 = >50% of students on free and reduced lunches) for students attending school *j*.

u_{0j} = random effects of the *j*th school unit on the intercept.

u_{1j} = random effects of the jth level-2 unit adjusted for perceived discrepancies in parent and student expectations on the slope.

ϵ_{ij}= random error associated with student *i* in school *j*.

Statistical Software

The statistical models outlined in the previous section will be evaluated using the open source software R and R Studio. The program R and R Studio were selected due to my familiarity with the software and the ability of R Studio to robustly handle multilevel models such as those used in this study.

Validity and Reliability

The current study attempts to understand the relationship between student expectations, parent expectations, school level poverty, and student academic outcomes – both immediate and long-term – by furthering the work of both Wang and Benner (2014) and McNeal (2014) while using the NELS:88 data. Both studies pointed out two common limitations of their work, and thus limitations of the present study – the age of the data source (now 30 years old) and the exclusive reliance of the data on high school aged students. The remainder of this section will discuss how those limitations could impact the findings of this study and why I believe the results of this study should not be discounted by either limitation.

A three-decade old data set may seem limiting the application of the findings, but as McNeal (2014) suggests in his research, regardless of the age of the data, the impact of parent involvement on student outcomes has not diminished. Wang & Benner (2014), McNeal (2014) and others do not present evidence of time-related changes in the relationships among key variables in their studies. Moreover, as was stated earlier in this paper, federal dollars for schools continues to be tied to the successful implementation and participation of parents in parent involvement programs. While parent involvement programs continue to evolve, and certainly differ between schools, the multi-level nature of this model should provide valuable data for school and parent leaders to assist and inform these leaders during the development process.

While the data used in this study is limited to high school students, the findings should not be considered limited in implications to only this age group. First, the finding of impactful programs that can enhance a student's academic success and expectations at such a late point in a student's academic life could have an invaluable impact on helping to prepare students for future success – regardless of the path chosen. While impossible to quantify the impact of similar programs on younger students, it could be surmised that these programs could have, at a very minimum, some positive effect on a younger student's academic performance. Parent expectations communicated at an early age have been found to positively impact students' academic success (Jeynes; 2003, 2005) and so the findings from the current research should inform future programs about helping parents develop and communicate their own expectations to their children.

Institutional Review Board Approval Process

Prior to any analyses, an application for Institutional Review Board (IRB) approval was submitted. Because this study employed a public data set from the NELS:88 national study, a request for exempt status was submitted on January 3rd, 2019 to the Southern Methodist University (SMU) IRB Approval Committee (Appendix A). An evaluation of my exempt status was accepted by the SMU IRB committee on January the 4th and the unique ID of H19-033-SUHT (Appendix B) was assigned to my study. A request to complete the Principal Investigator's Assurance form and proof of completion of the Collaborative Institutional Training Initiative (CITI) Human Subjects Training was requested by the SMU IRB committee. Both requests were completed by me on January 4th and proof of such was returned to the SMU IRB Committee (Appendix C and Appendix D). On January 8th my study was approved to commence by the SMU IRB committee. A copy of the approval letter is included in this dissertation under Appendix E.

Summary of the Research Methods

Urie Bronfenbrenner (1979, 1986, 1992, 2005) theorized that connections within a child's life immensely impacted how that child would develop. This theory not only considered those direct relationships with the child, but relationships and actions outside of the child's immediate circle of relationships. Parent involvement and student outcome at times, have been researched as a single dyad in the ecological development of a child, not considering other environmental factors that could impact the strength of the relationship between parent involvement and student academic success. While the impact of parent involvement on a student's success in school is a widely researched topic, Fan and Chen (2001), while examining a multitude of parent involvement studies in their meta-analysis, found that of all parent involvement activities and practices, parent expectations had the greatest impact on a student's academic success. Recent studies by Wang and Benner (2014) and McNeal (2014) advance the work of Fan and Chen by inspecting the impact of parent expectations while taking into consideration environmental connections within a student's ecological system.

This study proposed to expand upon the work of Wang and Benner (2014) by closely replicating the nesting modeled by McNeal (2014) to investigate the phenomenon of parent expectations through the lens of Bronfenbrenner's (1979, 1986, 1992, 2005) theory of bioecological systems. I choose a multilevel model to examine the relationship between student expectations, discrepancies between parent and student expectations, and academic outcomes (test scores and a student's future expectations of academic attainment). Furthermore, this research expanded the scope of the aforementioned relationship by investigating how these relationships are moderated by the school-level variable 'school poverty'. This chapter reviewed the research methods used in this study and in detail, the rationale behind the methods I used.

Additionally, this chapter described the participants, data set, research questions, hypotheses, variables, statistical models, limitations, and software used within this study.

Chapter 4: Analysis and Findings

Grounded in the ecological systems theory of Bronfenbrenner (1979, 1986, 1992, 2005) and motivated by the findings of Fan and Chen (2001) that of all forms of parent involvement, parent expectations are the greatest predictor of academic achievement, this study sought to understand the how the relationship between a student's own expectations and the discrepancy between the student's expectations and her parent's expectations of academic achievement (both actual and perceived) influenced academic outcomes. Employing a subset of the NELS:88 data set, this study used a multilevel model of students nested in schools to examine how the relationship predicted a student's results on standardized tests and a student's future expectations of academic attainment. This chapter will detail how the NELS:88 data set was cleaned to create four subsets of participants (one for each of the two outcome variables for both actual and perceived expectations of the parents), how each multilevel model was specified and estimated using R software.

Preparing the Data

Subsets of the NELS:88 data set were created for use in this study. Careful consideration was taken to determine which students of the original 22,511 participants of the NELS:88 study would be included in my study. There were two data sets prepared for each variable related to discrepancies in expectations of academic attainment – DIS_ACTEX (actual discrepancies) and DIS_PEREX (perceived discrepancies) – to allow for evaluation of each outcome variable independently, meaning that a total of four data sets were created for use within this analysis. To be included in a data set each participant had to have been a participant in the initial year of the study (1988), answered questions on the base-year student survey related to her own expectations and what she perceived her parents expectations to be, completed the year-four student survey (1992), had at least one parent complete a base-year parent survey and answer question related to the parent's expectations of her student's academic attainment, and the student had to have completed the all four standardized tests being evaluated for each specific data set or answered the year-four survey question related to expectations of future academic attainment.. A detailed explanation of how each data set was created is listed below:

Procedures for preparing data to evaluate perceived discrepancies impacting academic outcomes:

1. I cleaned NELS:88 data set to contain only those variables that were used in my analysis. The variables included in my study were:
    a. STU_ID – a unique identifier for each individual student
    b. SCH_ID – a unique identifier for each individual school
    c. BYS45 – a student's expectation of academic achievement taken from the base-year student survey. So that this study would closely resemble the methodologies used by Wang and Benner (2014), the scale for this variable was condensed from its previous scale of 1 through 6, to 0 through 4. The scales for the NELS:88 data set, and the subset of data used within this study are detailed below.

       Scale used in the original NELS:88 data set:

       1 – Won't finish high school

       2 – Will finish high school

       3 – Vocational, trade, or business school after high school

       4 – Will attend college

       5 – Will finish college

       6 – Higher school after college

       Scale employed within this study:

0 – Does not expect to complete high school (Response 1 from original NELS:88 scale)

1 – Graduate high school or receive a GED (Response 2 from original NELS:88 scale)

2 – Some post high school education (Response 3 and 4 from original NELS:88 scale)

3 – Receive a bachelor's degree (Response 5 from original NELS:88 scale)

4 – Complete education beyond a bachelor's degree (Response 6 from original NELS:88 scale)

d. BYS48A – a student's father's expectations of academic achievement as perceived by the student, taken from the base-year student survey. So that this study would closely resemble the methodologies used by Wang and Benner (2014), the scale for this variable was condensed from 1 through 6 used in the original NEL:88 data set, to 0 through 4. The two scales are defined below.

Scale used in the original NELS:88 data set:

1 – Won't finish high school

2 – Will finish high school

3 – Vocational, trade, or business school after high school

4 – Will attend college

5 – Will finish college

6 – Higher school after college

Scale employed within this study:

0 – Does not expect to complete high school (Response 1 from original NELS:88 scale)

1 – Graduate high school or receive a GED (Response 2 from original NELS:88 scale)

2 – Some post high school education (Responses 3 and 4 from original NELS:88 scale)

3 – Receive a bachelor's degree (Response 5 from original NELS:88 scale)

4 – Complete education beyond a bachelor's degree (Response 6 from original NELS:88 scale)

e. BYS48B – a student's mother's expectations of academic achievement as perceived by the student, taken from the base-year student survey. So that this study would closely resemble the methodologies used by Wang and Benner (2014), the scale for this variable was condensed from 1 through 6 used in the original NEL:88 data set, to 0 through 4. The two scales are defined below.

Scale used in the original NELS:88 data set:

1 – Won't finish high school

2 – Will finish high school

3 – Vocational, trade, or business school after high school

4 – Will attend college

5 – Will finish college

6 – Higher school after college

Scale employed within this study:

0 – Does not expect to complete high school (Response 1 from original NELS:88 scale)

1 – Graduate high school or receive a GED (Response 2 from original NELS:88 scale)

2 – Some post high school education (Responses 3 and 4 from original NELS:88 scale)

3 – Receive a bachelor's degree (Response 5 from original NELS:88 scale)

4 – Complete education beyond a bachelor's degree (Response 6 from original NELS:88 scale)

f. G8LUNCH – a school's level of poverty measured by the percentage of student's on free and reduced lunch program for each individual school. This is a school level variable conceptualized to represent community SES, or the macrosystem (societal structure), of Bronfenbrenner's (1979, 1986, 1992, 2005) ecological systems theory.

g. SEX – a student's gender based on a self-reported item on the base-year student survey.

0 – Male

1 – Female

h. RACE – For purposes of this study, like McNeal (2014), the race variable was condensed into a variable indicating whether a student was a minority or not (not white). The original scale of 1 to 5 used for the NELS:88 data set, was combined to a scale of 0 or 1 for this study. It was possible for the student to select more than one answer on the original base-year survey, in which case they would be classified as a minority (1) within this study. The two scales are defined below.

The scales used in the original NELS:88 data set:

1 - Asian / Pacific Islander

2 - Hispanic

3 - Black not Hispanic

4 - White not Hispanic

5 – Native American / Alaskan Native

Scale used within this study:

0 – Not Minority (Response 4 within the original NELS:88 data set)

1 – Minority (Reponses 1, 2, 3, and 5 or any combination of answers from the original NELS:88 data set)

i. TestScore – a student's combined score (all four test scores added together) of four standardized (history, math, reading, and science) tests that were administered in 12^{th} grade. The scores associated with the TestScore variable are the result of the addition of F22XHIRR, F22XMIRR, F22XRIRR, and F22XSIRR variables.

j. F22XRIRR – a student's standardized number of correct responses on a standardized math test that was administered in 12^{th} grade

k. F22XMIRR – a student's standardized number of correct responses on a standardized math test that was administered in 12^{th} grade

l. F22XSIRR – a student's standardized number of correct responses on a standardized science test that was administered in 12^{th} grade

m. F22XHIRR – a student's standardized number of correct responses on a standardized history test that was administered in 12th grade

n. F2S43 – a student's future expectation of academic achievement based on a self-reported item on the fourth-year follow-up student survey. So that this study would closely resemble the methodologies used by Wang and Benner (2014), the scale for this variable was condensed from the original scale of 1 through 10, to 0 through 4. The two scales are defined below.

Scale used in the original NELS:88 data set:

1 – Less than high school

2 – High school only

3 – Less than 2 years of school after high school

4 – More than 2 years of school after high school

5 – Trade school degree

6 – Less than 2 years of college

7 – More than 2 years of college

8 – Graduate college

9 – Master's or equivalent

10 – PhD, M.D., or other

Scale employed within this study:

0 – Does not expect to complete high school (Response 1 from original NELS:88 scale)

1 – Graduate high school or receive a GED (Response 2 from original NELS:88 scale)

2 – Some post high school education (Responses 3, 4, 5, 6, and 7 from original NELS:88 scale)

3 – Receive a bachelor's degree (Response 8 from original NELS:88 scale)

4 – Complete education beyond a bachelor's degree (Responses 9 and 10 from original NELS:88 scale)

2. I eliminated students who were not associated with a school (SCH_ID was missing). Since my research evaluated students nested in schools, having a school identification number was critical.
3. Since my study examined the impact perceived discrepancies in expectations between students and parents had on academic outcomes, I eliminated students from the data set who did not answer item BYS_45, a student's own expectation of academic attainment, on the base-year student survey.
4. Of equal importance to a student's own expectations of academic achievement was how she perceived the expectation of her academic achievement by parents. If a student did not answer either of item BYS48A (a father's expectation as perceived by the student) or BYS48B (a mother's expectation as perceived by the student), she was removed from the data set used for my analysis.
5. I removed any student from the file that went to a school where the level of poverty could not be determined (missing answer to G8LUNCH). This is critical because this study will evaluate the moderating effects of poverty using G8LUNCH as the moderating variable. For this variable 0 represents a school that has 50% or less of its students on free or reduced lunches, while 1 represents a school that has 51% or more of its students on free or reduced lunches.

6. PER_PAREX was created to represent perceived parent expectations. The variable was calculated by averaging a student's answers on BYS48A and BYS48B. If either BYS48A or BYS48B were missing, PER_PAREX was derived by using only the variable for which an answer was provided. If neither was answered, the student was removed from the data set.
7. DIS_PEREX was created to represent the differences in a student's expectations of academic achievement and her parent's expectations of her academic achievement as perceived by the student. The variable BYS45 (student expectation) was subtracted from PER_PAREX (perceived parent expectation) to determine DIS_PEREX (perceived discrepancies in expectations). This meant that if the calculated number for DIS_PEREX was positive, the perceived parent expectations were higher than the student's own expectations.
8. The next step was to create subsets of the perceived data set based on outcome variables. These CSV files of these subsets were labeled in the analysis as testscores_per and futureex_per. Students were only included in a data set if they had a score for all four standardized tests or answered the fourth-year survey item f2S43. The breakdown for each data set was as follows:
    a. totalscore_per – students must have had a score for each of the variables F22XHIRR, F22XMIRR, F22XRIRR, and F22SIRR. The number of students included in this sample were 10,643 nested in 944 schools.
    b. futureex_per – students must have had an answer for the variable F2S43. The number of students included in this sample were 11,859 nested in 955 schools.

Procedures for preparing data to evaluate actual discrepancies impacting academic outcomes:

The procedures used for preparing the actual discrepancy data sets were the exact procedures used for perceived discrepancy data sets other than the treatment of the discrepancy variable. Below are the steps of how actual discrepancies data sets were created that differed from the creation of the perceived discrepancies data sets.

1. BYP76 (parent's expectations)– a parent's actual expectations of her student's academic achievement taken from the base-year parent survey. So that this study would closely resemble the methodologies used by Wang and Benner (2014), the scale for this variable was condensed from the 1 to 12 scale used in the original NELS:88 data set, to 0 through 4. The two scales are defined below.

    Scale used in the original NELS:88 data set:

    1 – Less than high school diploma

    2 – GED

    3 – High school graduation

    4 – Vocational, trade, or business school < 1 year

    5 – Vocational, trade, or business school 1 to 2 years

    6 – Vocational, trade, or business school more than 2 years

    7 – Less than 2 years of college

    8 – More than 2 years of college

    9 – Finish a 2-year program

    10 – Finish a 4 / 5-year program

    11 – Master's degree

    12 – PhD, M.D.

    Scale employed within this study:

0 – Does not expect to complete high school (Response 1 from original NELS:88 scale)

1 – Graduate high school or receive a GED (Responses 2 and 3 from original NELS:88 scale)

2 – Some post high school education (Responses 4 through 9 from original NELS:88 scale)

3 – Receive a bachelor's degree (Response 10 from original NELS:88 scale)

4 – Complete education beyond a bachelor's degree (Responses 11 and 12 from original NELS:88 scale)

2. The next step was to create subsets of the actual data set based on outcome variables. These CSV file name for these subsets were totalscore_act and futureex_act. Students were only included in a data set if they had a score on all four of the standardized tests (history, math, reading, and science) or answered the fourth-year survey item f2S43. The breakdown for each data set was as follows:
    a. totalscore_per – students must have had a score for each of the variables F22XHIRR, F22XMIRR, F22XRIRR, and F22SIRR. The number of students included in this sample were 11,710 nested in 945 schools.
    b. futureex_act - students must have had an answer for the variable F2S43. The number of students included in this sample were 12,954 nested in 956 schools.

Estimation of the Models

A model was specified and estimated independently for each outcome variable; combined results on history, math, reading, and science tests, as well as a student's future expectations of academic achievement. For each of these two outcome variables, two models were evaluated, one including the predictor variable DIS_ACTEX (actual discrepancies in expectations) and one including the predictor variable DIS_PEREX (perceived discrepancies in expectations). The software R was used to assess each model. This section describes how each model was evaluated, first by looking at the descriptive statistics, then evaluating the full multilevel analysis. The order of model estimation was combined standardized test scores (history, math, reading, and science) then a student's expectation of future academic attainment. For each outcome variable, actual discrepancies were evaluated first, after which perceived discrepancies were analyzed. The code file used in all the statistical analyses performed in this study, as well as the output, can be viewed in Appendix F and Appendix G.

Due to the fact that the variable names from the actual data set may be confusing to the reader and to assist the reader in understanding the definition of the many variables included in this analysis, Table 1 includes definitions of variable names that will be used for the remainder of this paper.

Table 1
Definition of variables

Labels	Short definition
BYS45C	Student expectations centered on the mean
BYS76C	Parent expectations centered on the mean
G8LUNCH	School poverty
PER_PAREX	Parent expectations as perceived by the student
DIS_PEREXC	Perceived discrepancies in expectations centered on the mean
DIS_ACTEXC	Actual discrepancies in expectations centered on the mean
TestScores	Combined score of all standardized tests (Addition of F2XHIRR, F22XMIRR, F22XRIRR, and F22XSIRR)
F22XHIRR	History test scores
F22XMIRR	Math test scores
F22XRIRR	Reading test scores
F22XSIRR	Science test scores
F2S43	Student's future expectations of academic attainment

Descriptive statistics for initial NELS:88 data set

Descriptive statistics for the initial NELS:88 data set were examined to compare participants from the initial data set to the subsets of data examined within this study. This was to ensure that there were no major discrepancies between the samples employed within this study and the original data set. Employing the 'describe' function in R, I produced a table of descriptive statistics to evaluate each variable within the alldata.csv data set independently (see Table 2). This data set included 22,511 participants nested in 975 schools, of which 11,209 were male (50%) and 11,302 were female and 6,979 (31%) reported being a minority (not white). The standardized mean score for the outcome variable of test scores – number of correct answers on combined standardized tests taken in 12th grade – was 141.59 with a range of 61.73 to 209.24. The standardized mean score for the outcome variable of future expectations of academic attainment was 3.01 with a range of 0 to 4. With respect to the variable of school poverty, 3,060 (14%) of the participants attended a school where more than 50% of the students were received free or reduced lunches.

Descriptive statistics for total score

The number of participants evaluated within this study (10,643 to 12,953) was much smaller than the original data set from NELS:88 (22,511) (see Table 2). This reduction in participants was due to students being eliminated from the data set if they did not answer certain questions that were pertinent to the present study. As explained earlier in this section if students did not answer questions about their current expectation of academic attainment, how they perceived their parent's expectations of their academic attainment to be, expectations of future academic attainment, or register a score on all four standardized tests, students were removed from the study. Additionally, if a student's parent did not answer the expectation question on the base-year NELS:88 survey or if a student was not associated with a school, these students were also removed.

Table 2
Descriptive Statistics for All Data Sets

	NELS:88	Total (ACT) Score	Total (PER) Score	Future (ACT) Expectation	Future (PER) Expectation
N	22,511	11,710	10,643	12,954	11859
Gender	M: 50% F: 50%	M: 50% F: 50%	M: 49% F: 51%	M: 49% F: 51%	M: 48% F: 52%
Minority	W: 69% M: 31%	W: 74% M: 26%	W: 74% M: 26%	W: 74% M: 26%	W: 75% M: 25%
School Poverty	N: 86% I: 14%	N: 89% I: 11%	N: 89% I: 11%	N: 89% I: 11%	N: 89% I: 11%
Total Score	141.59 (61.73 - 209.24)	141.95 (64.06 - 209.24)	143.50 (64.06 - 209.24)		
Future Expectations	3.01 (0 - 4)			3.01 (0 - 4)	3.03 (0 - 4)

Note: For gender M = male and F = female, for minority W = White and M = Non-white, for school poverty N = non-impoverished and I = impoverished.

Actual discrepancies. To better understand the participants in this model I investigated the variables within the totalscores_act subset of the NELS:88 data using R software. Employing the 'describe' function in R, I produced a table of descriptive statistics to evaluate each variable within the totalscores_act data set independently (see Table 2). This data set included 11,710 participants nested in 945 schools, of which 5,800 were male (50%) and 5,910 were female and 3,092 (26%) reported being a minority (not white). This subset of data had a lower percentage of minorities than the initial NELS:88 data set, indicating that more minorities than white students failed to take all four standardized tests. The standardized mean score for the outcome variable of test scores – number of correct answers on combined standardized tests taken in 12^{th} grade – was 141.95 with a range of 64.06 to 209.24. The overall mean for tests scores was slightly higher than the NELS:88 data set (141.59), as was the minimum of the range

(61.73 to 209.24 for entire NELS:88 data set). The predictor variables were centered on the mean with ranges of -2.88 to 1.12 for student expectations, -2.77 to 1.23 for actual parent expectations, and -3.89 to 4.11 for actual discrepancies in expectations. With respect to the variable of school poverty, 1,314 (11%) of the participants attended a school where more than 50% of the students received free or reduced lunches, slightly lower than the NEL:88 data set.

Perceived discrepancies. There were 10,643 students nested within 944 schools included in the history_per data set with 5,252 being male (49%) and 5,391 being female (See Table 2). Twenty six percent (2,728) of the participants reported being minority and 11% (1141) attended a school with more than 50% of students receiving free or reduced lunches. There were slightly fewer males for this subset than the original NEL:88 data and the number of minority students and students attending low-income schools were also lower than NELS:88 data. The standardized mean score for the outcome variable of test scores – number of correct answers on combined standardized tests taken in 12th grade – was 143.50 with a range of 64.06 to 209.24, both the mean score and the minimum were higher than the respective statistics the NELS:88 data set overall (mean = 141.59 and range = 61.73 to 209.24). The predictor variables had a range of -2.92 to 1.08 for student expectations, -3.03 to 0.97 for perceived parent expectations, and -4.11 to 3.89 for perceived discrepancies in expectations. These three variables were all centered on the mean.

Descriptive statistics for future expectations of academic attainment

Actual discrepancies. This data set included 12,954 participants nested in 945 schools, of which 6,309 were male (49%) and 6,645 were female and 3,401 (26%) reported being a minority (not white)(See Table 2). This subset of data had a lower percentage of males and minorities than the initial NELS:88 data set, indicating that more males than females, and minorities than white students failed to answer the fourth-year follow-up survey question related to future expectations of academic attainment. The standardized mean score for the outcome variable of future expectations of academic attainment was 3.01. The overall mean for future expectations was equal to that of the NELS:88 data set. The predictor variables were centered on the mean with ranges of -2.94 to 1.06 for student expectations, -2.83 to 1.17 for actual parent expectations, and -3.89 to 4.11 for actual discrepancies in expectations. With respect to the variable of school poverty, it indicated that 1,372 (11%) of the participants attended a school where more than 50% of the students were received free or reduced lunches , slightly lower than the NEL:88 data set.

Perceived discrepancies. There were 11,859 students nested within 944 schools included in the futureex_per data set with 5,769 being male (48%) and 6,090 being female (See Table 2). 25% (3023) of the participants reported being minority and 11% (1196) attended a school with more than 50% of students receiving free or reduced lunches. Gender was slightly lower for this subset than the original NEL:88 data and the number of minority students and students attending low-income schools were lower than NELS:88 data. The standardized mean score for the outcome variable of future expectations of academic attainment was 3.03, higher than that of the NELS:88 data set. The predictor variables had a range of -2.92 to 1.08 for student expectations, -3.03 to 0.97 for perceived parent expectations, and -4.11 to 3.89 for perceived discrepancies in expectations. These three variables were all centered on the mean.

HLM analysis for total scores

Actual discrepancies. In order to answer the questions and test the hypotheses proposed earlier in my study, a random effects multilevel analysis was run using the ‘lmer’ function within the R package ‘lmerTest’ (see Table 3). Using the previously described data set totalscores_act, students were nested in schools with the examined variables being RACE (minority or not), SEX (gender), DIS_ACTEXC (discrepancies in actual expectations) and BYS45C (student expectations) at the student level (level 1), G8LUNCH (school level poverty) at the school level (level 2), the interaction of DIS_ACTEXC and BYS45C, the interaction of DIS_ACTEXC and G8LUNCH, the interaction of BYS45C and G8LUNCH, and the 3-way interaction of DIS_ACTEXC, BYS45C, and G8LUNCH. The random effects of DIS_ACTEXC was also examined to investigate whether the impact of discrepancies in actual expectations on test scores varied between schools.

Answering research question 1, related to the impact of student expectations on a student's performance on standardized test scores, the main effect of student expectations indicated a significant positive relationship with test scores when controlling for the other variables in the model ($p < .001$). The effect size for student expectations was 0.56, indicating a strong relationship with test scores and that for every one standard deviation student expectations increased, test scores would be expected to increase 0.56 of a standard deviation.

Table 3

HLM Results for Actual Discrepancies Predicting Total Scores – Fixed Effects and Random Effects

	Estimate	Std. Error	df	t value	Pr(>|t|)
Fixed Effects					
Intercept	148.353***	0.512	1655.9916	288.490	<2e-16 ***
Minority	-12.7526	0.6394	9852.9877	-19.946	< 2e-16 ***
Standardized	-0.17				
Gender	-3.8153	0.4819	11501.6977	-7.918	2.64e-15 ***
Standardized	-.06				
Actual discrepancy	11.1337	0.3359	1045.1643	33.146	< 2e-16 ***
Standardized	0.30				
Student expectation	20.2627	0.3446	11548.7064	58.793	< 2e-16 ***
Standardized	0.56				
School poverty	-10.8111	1.2740	1271.6458	-8.486	< 2e-16 ***
Standardized	-0.10				
Interactions					

Actual discrepancy & student expectation	0.4273	0.2881	4576.4881	1.483	0.138
Actual discrepancy & school poverty	-4.9949	0.8738	814.7867	-5.717	1.53e-08 ***
Student expectation & school poverty	-7.2282	0.9374	11655.8391	-7.711	1.35e-14 ***
Actual discrepancy & student expectations & school poverty	2.9897	0.6936	5742.0102	4.310	1.66e-05 ***
Random Effects	*Variance*	*Std. Deviation*	*Corr*		
SCH_ID (Intercept)	83.5989	9.143			
Discrepancies in exp.	0.9448	0.972	-0.44		
Residual	630.2185	25.104			

· $p < .1$ *$p < .05$; ** $p < .01$; *** $p < .001$

Addressing Research Question 2, investigating the impact of actual discrepancies on total scores, the main effect of actual discrepancies indicated a significant positive relationship with total scores when controlling for the other variables included in the model ($p < .001$). This finding suggests that when all other variables are at 0, and there is an increase in actual discrepancies (parent having a higher expectation than the student), test scores would be expected to increase. The strength of the relationship between actual discrepancies and test scores was strong as well, as the effect size of 0.30 indicated. This suggests that as actual discrepancies increase one standard deviation, test scores would be expected to increase 0.30 of a standard deviation.

Gender, minority, and school poverty had significant main effects on test scores ($p < .001$). The main effect of gender suggests that females would be expected to score lower on test scores compared to a male when controlling for all other variables in the model. The strength of the relationship between gender and test scores was low as indicated by the -0.06 effect size. The finding indicates that going from males to female, test scores would be expected to decrease

0.06 of a standard deviation. Similarly, minorities also would be expected to score lower on tests than would white students, although the strength of the relationship of race and test scores was stronger than gender, the effect size was still low at -0.17. The school level variable of school poverty has a main effect on test scores, in that students who attend an impoverished school (more than 50% of students receiving free or reduced lunches) would be predicted to have a lower test score than those who did not, when controlling for all other variables ($p < .001$). The effect size of -0.10 for school poverty indicates that the relationship between school poverty and test scores is low. The finding indicates that going from non-impoverished to impoverished schools, test scores would be expected to decrease 0.10 of a standard deviation.

Regarding Research Question 4, the interaction of actual discrepancies and school poverty in their relationship to student achievement was significant ($p < .001$). For students attending impoverished schools (greater than 50% on free or reduced lunches), as actual discrepancies increased (parent held higher expectations than the student) her total test scores would be expected to decrease. For students attending a non-impoverished school, expectations were not related to test scores.

The interaction of student expectations and school poverty in their relationship to test scores was also significant ($p < .001$). This result indicated that if a student attended an impoverished school, as her own expectations increased, her total test score would be expected to decrease. For a student attending a non-impoverished school, student expectations were not related to test scores.

With respect to test scores, the three-way interaction between school poverty, actual discrepancies and student expectations was significant ($p < .001$). For students attending an impoverished school, there was a significant interaction between actual discrepancies and student expectations in their relationship to test scores. That is, the relationship between student expectations and test scores became stronger as actual discrepancies increased. For students in a non-impoverished school, the interaction between actual discrepancies and student expectations was not significant.

The random effects of DIS_ACTEXC was evaluated within this model to examine the Research Question 8, testing if the impact of actual discrepancies in expectations on scores of the combined standardized tests varied between schools. To evaluate whether results varied by school, a fixed effects model was run and compared to the random effects model using the 'anova' function within the R software package. The table produced after running the ANOVA showed that the random model was a significantly better fit than the fixed effects model (p <.001).

	Df	AIC	BIC	logLik	deviance	Chisq	Chi Df	Pr(>Chisq)
Scores_Act2	11	109683	109764	-54830	109661			
Scores_Act	14	109617	109720	-54794	109589	72.006	3	1.587e-15 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

The outcome signified that the impact of actual discrepancies between student and parent expectations on scores on standardized history tests significantly varied between schools.

Perceived discrepancies. Like the analysis run for actual discrepancies predicting test scores, a model was developed to analyze the relationship between discrepancies in perceived expectations and test scores (see Table 4). Using the data set totalscores_per, students were nested in schools with the examined variables being RACE (minority or not), SEX (gender), DIS_PEREXC (discrepancies in perceived expectations), and BYS45C (student expectations) at the student level (level 1), G8LUNCH (school level poverty) at the school level (level 2), the interaction of DIS_PEREXC and BYS45C, the interaction of DIS_PEREXC and G8LUNCH, the interaction of BYS45C and G8LUNCH, and the 3-way interaction of DIS_PEREXC, BYS45C and G8LUNCH. The random effects of DIS_PEREXC (discrepancies in perceived expectations) was also examined.

Regarding Research Question 1, when controlling for other variables in the model, student expectations were positively related to test scores ($p < .001$). This suggests that as a student's expectation increases, her combined test score should increase. The effect size for student expectations was 0.46, indicating a strong relationship with test scores and that for every one standard deviation student expectations increased, test scores would be expected to increase 0.46 of a standard deviation.

Research Question 3 inquired about the relationship between perceived discrepancies and total scores. The main effect of perceived discrepancies indicated a significant positive relationship with total scores when controlling for the other variables included in the model ($p < .001$). This finding suggests that when all other variables are at 0, as students believe that their parents have higher expectations than they do, test scores would be expected to increase. The strength of the relationship between perceived discrepancies and test scores was weak, as the effect size of 0.11 indicated. This suggests that as perceived discrepancies increase one standard deviation, test scores would be expected to increase 0.11 of a standard deviation.

Gender, minority, and school poverty showed significant main effects on test scores ($p < .001$). The main effect of gender suggests that females would be expected to score lower on test scores compared to males when controlling for all other variables in the model. The strength of the relationship between gender and test scores was low as indicated by the effect size of -0.06. The finding indicates that going from male to female, test scores would be expected to decrease 0.06 of a standard deviation. Similarly, minorities would be expected to score lower on tests than would white students, although the strength of the relationship of race and test scores was stronger than gender, the effect size was still low at -0.16.

The school level variable of school poverty indicated a main effect as it showed to have a significant negative relationship with total scores, signifying that students who attend an impoverished school (more than 50% of students receiving free or reduced lunches) would be predicted to have a lower test score than those who did not, when controlling for all other variables ($p < .001$). The effect size of -0.11 for school poverty indicates that the relationship

Table 4

HLM Results for Perceived Discrepancies Predicting Total Scores – Fixed Effects and Random Effects

	Estimate	Std. Error	df	t value	Pr(>|t|)
Fixed Effects					
Intercept	149.5574	0.5756	1587.7092	259.826	< 2e-16 ***
Standardized					
Minority	-12.0105	0.7060	9148.3872	-17.012	< 2e-16 ***
Standardized	-0.16				
Gender	-4.0860	0.5252	10388.2242	-7.779	7.98e-15 ***
Standardized	-0.06				
Perceived discrepancy	4.8944	0.5097	1520.8875	9.603	< 2e-16 ***
Standardized	0.11				
Student expectation	16.9067	0.3920	10555.7760	43.133	< 2e-16 ***
Standardized	0.46				
School poverty	-12.3257	1.4313	1225.9453	-8.611	< 2e-16 ***
Standardized	-0.11				
Interactions					
Perceived discrepancy & student expectation	0.1852	0.3318	2020.2673	0.558	0.5768
Perceived discrepancy & school poverty	-1.5836	1.3217	813.3305	-1.198	0.2312
Student expectation & school poverty	-4.9509	1.0977	10499.6760	-4.510	6.55e-06 ***
Perceived discrepancy & student expectations & school poverty	1.8911	0.8401	2140.0716	2.251	0.0245 *
Random Effects	*Variance*	*Std. Deviation*	*Corr*		

SCH_ID (Intercept)	116.545	10.796	
Discrepancies in exp.	9.134	3.022	-0.56
Residual	671.480	25.913	

· *p* < .1 **p* < .05; ** *p* < .01; *** *p* < .001

between school poverty and test scores is low, and that going from a non-impoverished school to an impoverished school, test scores would decrease 0.11 of a standard deviation.

Controlling for the other variables in the model and addressing Research Question 5, the interaction of perceived discrepancies and school poverty showed no significant effect, indicating no relationship to test scores. The interaction of student expectations and school poverty, however, was significant ($p < .001$). This result indicated that if a student attended an impoverished school – greater than 50% on free or reduced lunches – as her own expectations increased, her total test score would be expected to decrease. For students attending a non-impoverished school, expectations were not related to test scores.

With respect to test scores, the three-way interaction between school poverty, perceived discrepancies and student expectations was significant ($p < .05$). For students attending an impoverished school, there was a significant interaction between perceived discrepancies and student expectations in their relationship to test scores. That is, the relationship between student expectations and test scores became stronger as perceived discrepancies increased. For students in a non-impoverished school, the interaction between perceived discrepancies and student expectations was not significant.

To address Research Question 8, the random effects of DIS_PEREXC was evaluated within this model to examine whether the impact of perceived discrepancies in expectations on scores of the combined standardized tests varied between schools. To evaluate whether results varied by school, a fixed effects model was run and compared to the random effects model using the 'anova' function within the R software package. The table produced after running the ANOVA showed that the random model was a significantly better fit than the fixed effects model (*p* <.001).

	Df	AIC	BIC	logLik	deviance	Chisq	Chi Df	Pr(>Chisq)
Scores_Per2	12	100516	100603	-50246	100492			
Scores_Per	14	100506	100607	-50239	100478	14.476	2	0.0007186 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

The chi square was statistically significant indicating that the impact of actual discrepancies between student and parent expectations on scores on standardized history tests significantly varied between schools (*p* < .001).

HLM analysis for future expectations of academic attainment

Actual discrepancies. In order to answer the research questions and examine the hypotheses proposed in my study, a random effects multilevel analysis was run using the 'lmer' function within the 'lmerTest' library in the R software package (see Table 5). Using the previously mentioned data set futureex_act, students were nested in schools with the examined variables being RACE (minority or not), SEX (gender), DIS_ACTEXC (actual discrepancies in expectations) and BYS45C (student expectations) at the student level (level 1), G8LUNCH (school level poverty) at the school level (level 2), the interaction of DIS_ACTEXC and BYS45C, DIS_ACTEXC and G8LUNCH, the interaction of BYS45C and G8LUNCH, and the 3-way interaction of DIS_ACTEXC, BYS45C and G8LUNCH. The random effects of DIS_ACTEXC was also examined.

Regarding Research Question 1, student expectations were positively related to future expectations when controlling for the other variables in the model (*p* < .001). This implies that as a student's expectation increases, her expectation of future academic attainment – how far she will go in school – should be expected to increase. The effect size for student expectations was

Table 5

HLM Results for Actual Discrepancies Predicting Future Expectations – Fixed Effects and Random Effects

	Estimate	Std. Error	df	t value	Pr(>|t|)
Fixed Effects					
Intercept	2.956e+00	1.229e-02	2.062e+03	240.523	< 2e-16 ***
Minority	5.123e-02	1.697e-02	8.276e+03	3.019	0.002544 **
Standardized	0.02				
Gender	7.558e-02	1.339e-02	1.291e+04	5.644	1.69e-08 ***
Standardized	0.04				
Actual discrepancy	2.706e-01	1.012e-02	1.073e+03	26.739	< 2e-16 ***
Standardized	0.27				
Student expectation	6.095e-01	9.723e-03	1.160e+04	62.689	< 2e-16 ***
Standardized	0.59				
School poverty	-8.829e-02	2.989e-02	1.536e+03	-2.954	0.003184 **
Standardized	-0.03				
Interactions					
Actual discrepancy & student expectation	-9.676e-03	8.390e-03	6.238e+03	-1.153	0.248803
Actual discrepancy & school poverty	-8.015e-02	2.732e-02	1.022e+03	-2.934	0.003422 **
Student expectation & school poverty	-9.451e-02	2.769e-02	1.274e+04	-3.413	0.000645 ***
Actual discrepancy & student expectations & school poverty	1.608e-02	2.093e-02	6.784e+03	0.769	0.442197
Random Effects	*Variance*	*Std. Deviation*	*Corr*		
SCH_ID (Intercept)	0.02554	0.1598			
Discrepancies in exp.	0.01076	0.1037	-0.09		
Residual	0.54807	0.7403			

· $p < .1$ *$p < .05$; ** $p < .01$; *** $p < .001$

0.59, indicating a strong relationship with expectations of future achievement and that for every one standard deviation student expectations increased, expectations of future achievement would be expected to increase 0.59 of a standard deviation. Similarly, the main effect of actual discrepancies has a significant positive relationship with future expectations when controlling for the other variables included in the model ($p < .001$). This finding suggests that when all other variables are at 0, and there is an increase in actual discrepancies (parent having a higher expectation than the student), a student's expectation of future academic attainment would be expected to increase. The strength of the relationship between actual discrepancies and test scores was moderate, as the effect size of 0.27 indicates. This suggests that as actual discrepancies increase one standard deviation, expectation of future achievement would be expected to increase 0.27 of a standard deviation.

Gender had a significant main effect on the impact of future expectations ($p < .001$). The positive effect of gender suggests that females would be expected to have higher expectations of academic attainment compared to a male when controlling for all other variables in the model. The strength of the relationship between gender and test scores was low as the 0.04 effect size would indicate. The finding indicates that going from male to female, future expectations would be expected to increase 0.04 of a standard deviation. In the same vein, the significant main effect of minorities signified that minorities also would be expected to have higher future expectations of academic achievement than would white children ($p < .05$). The strength of the relationship of race and future expectations was also low with the effect size at 0.02.

The school level variable of school poverty indicated a main effect as it showed to have a significant negative effect, signifying that students who attended an impoverished school (more than 50% of students receiving free or reduced lunches) would be predicted to have a lower test score than those who did not, when controlling for all other variables ($p < .05$). The effect size of -0.03 for school poverty indicates that the relationship between school poverty and future expectations is low, and that going from a non-impoverished school to an impoverished school, future expectations would decrease 0.03 of a standard deviation.

Research Question 6 posed whether school poverty moderated the relationship between actual discrepancies in expectations and a student's future expectations of academic attainment. The interaction of actual discrepancies and school poverty had a significant effect on a student's future expectations of academic achievement while controlling for the other variables in the model ($p < .05$). For students attending an impoverished school, as actual discrepancies increased, the student's expectation of future academic attainment would be expected to decrease. For students attending non-impoverished schools, discrepancies in expectations were not related to future expectations.

The interaction of student expectations and school poverty was significant ($p < .001$). For students attending an impoverished school, as her own expectations of academic attainment increased, her future expectations of academic attainment would be expected to increase. For students attending non-impoverished schools, expectations were not related to future expectations.

The three-way interaction between actual discrepancies, student expectations, and school poverty was not significant for future expectations. This finding suggests that the interaction of student expectations and actual discrepancies with respect to a student's expectation of future academic attainment was not influenced by school poverty. The two-way interaction effect was the same for both impoverished and non-impoverished schools.

The random effects of DIS_ACTEXC was evaluated within this model to examine whether the impact of actual discrepancies in expectations on future expectations varied between schools (Research Question 8). To evaluate whether results varied by school a fixed effects model was run and compared to the random effects model using the ‘anova’ function within the R software package. The table produced after running the ANOVA showed that the random model was a significantly better fit than the fixed effects model (p <.001).

	Df	AIC	BIC	logLik	deviance	Chisq	Chi Df	Pr(>Chisq)	
futureexACT2	12	29632	29721	-14804	29608				
futureexACT	14	29616	29721	-14794	29588	19.346	2	6.296e-05	***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

The outcome signified that the impact of actual discrepancies between student and parent expectations on future expectations of academic attainment significantly varied between schools.

Perceived discrepancies. Like the process used in evaluating the relationship between actual discrepancies and future expectations, I created a data set futureex_per, to analyze the relationship between perceived discrepancies and future expectations of academic outcomes. I examined the variables RACE (minority or not), SEX (gender), DIS_PEREXC (perceived discrepancies in expectations) and BYS45C (student expectations) at the student level (level 1), G8LUNCH (school poverty level) at the school level (level 2), the interaction of DIS_PEREXC and BYS45C, the interaction of DIS_PERTEXC and G8LUNCH, the interaction of BYS45C and G8LUNCH, and the 3-way interaction of DIS_PEREXC, BYS45C and G8LUNCH. The random effects of DIS_PEREXC was also examined.

Investigating the main effects of this model and answering Research Question 1, student expectations had a significant positive relationship with future expectations when controlling for the other variables in the model (p < .001). This indicated that as a student’s expectation increased, her future expectations of academic attainment would be expected to increase. The effect size for student expectations was 0.50, indicating a strong relationship with future expectations of academic achievement and that for every one standard deviation student expectations increased, expectations of future achievement would be expected to increase 0.50 of a standard deviation. Similarly, the main effect of perceived discrepancies has a significant positive relationship with future expectations when controlling for the other variables included in the model ($p < .001$). This finding suggests that when all other variables are at 0, and there is an increase in actual discrepancies (parent having a higher expectation than the student), future expectations would be expected to increase. The strength of the relationship between perceived discrepancies and future expectation was low, indicated by the effect size of 0.11. This suggests that as actual discrepancies increase one standard deviation, expectation of future achievement would be expected to increase 0.11 of a standard deviation.

Gender, minority, and school poverty also had significant main effects on future expectations ($p < .001$). The main effect of gender suggests that females would be expected to have higher future expectations of academic attainment compared to males when controlling for all other variables in the model. The strength of the relationship between gender and test scores was low as the 0.04 effect size would indicate. The finding indicates that going from male to female, future expectations would be expected to increase 0.04 of a standard deviation. Comparably, minorities would be expected to have higher future expectations than would white children. The strength of the relationship of race and future expectations was also low with the effect size at 0.03.

Table 6

HLM Results for Perceived Discrepancies Predicting Future Expectations – Fixed Effects and Random Effects

	Estimate	Std. Error	df	t value	Pr(>|t|)
Fixed Effects					
Intercept	2.980e+00	1.363e-02	1.976e+03	218.672	< 2e-16 ***

Minority	6.387e-02	1.848e-02	8.673e+03	3.456	0.000551 ***
Standardized	0.03				
Gender	7.194e-02	1.428e-02	1.176e+04	5.037	4.8e-07 ***
Standardized	0.04				
Perceived discrepancy	1.307e-01	1.460e-02	1.394e+03	8.956	< 2e-16 ***
Standardized	0.11				
Student expectation	5.231e-01	1.078e-02	1.154e+04	48.540	< 2e-16 ***
Standardized	0.50				
School poverty	-1.241e-01	3.337e-02	1.487e+03	-3.719	0.000207 ***
Standardized	-0.04				
Interactions					
Perceived discrepancy & student expectation	-7.798e-03	9.682e-03	2.782e+03	-0.805	0.420636
Perceived discrepancy & school poverty	-5.391e-02	3.922e-02	9.640e+02	-1.375	0.169605
Student expectation & school poverty	-5.724e-02	3.114e-02	1.179e+04	-1.838	0.066074 .
Perceived discrepancy & student expectations & school poverty	-2.244e-02	2.590e-02	2.453e+03	-0.866	0.386351
Random Effects	*Variance*	*Std. Deviation*	*Corr*		
Intercept	0.04041	0.2010			
Discrepancies in exp.	0.01778	0.1333	-0.03		

· $p < .1$ *$p < .05$; ** $p < .01$; *** $p < .001$

The school level variable of school poverty indicated a significant effect, signifying that students who attend an impoverished school (more than 50% of students receiving free or reduced lunches) would be predicted to have lower future expectations than those who did not, when controlling for all other variables ($p < .001$). The effect size of -0.04 for school poverty indicates that the relationship between school poverty and future expectations is low, and that going from a non-impoverished school to an impoverished school, future expectations would decrease 0.04 of a standard deviation.

Attempting to answer Research Question 7, the interaction of perceived discrepancies and school poverty had no significant effect on future expectations while controlling for the other variables in the model. Similarly, the three-way interaction between perceived discrepancies, student expectations, and school poverty was not significant for future expectations. This finding suggests that the interaction of student expectations and perceived discrepancies with respect to a student's expectation of future academic attainment was not influenced by school poverty. The two-way interaction effect was the same for both impoverished and non-impoverished schools.

The interaction of student expectations and school poverty was significant ($p < .1$). This result indicated that if a student attended an impoverished school, as her own expectations increased, her future expectations would be expected to decrease. For a student attending a non-impoverished school, student expectations were not related to future expectations.

The random effects of DIS_PEREXC was evaluated within this model to examine whether the impact of perceived discrepancies in expectations on future expectations of academic attainment varied between schools (Research Question 8). To evaluate whether results varied by school, a fixed effects model was run and compared to the random effects model using the ‘anova’ function within the R software package. The table produced after running the ANOVA showed that the random model was a significantly better fit than the fixed effects model ($p <.001$).

	Df	AIC	BIC	logLik	deviance	Chisq	Chi Df	Pr(>Chisq)
futureexPER2	12	27652	27740	-13814	27628			
futureexPER	14	27636	27739	-13804	27608	20.137	2	4.24e-05 ***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

The outcome signified that the impact of actual discrepancies between student and parent expectations on future expectations of academic attainment significantly varied between schools.

Summary

The chapter explained the why the NELS:88 data was selected, how it was cleaned for usefulness within this study, what R code was used for analysis, the results of the analysis (summarized in Table 7), and how these results answered the research questioned posed in this study. This research sought to discover the impact discrepancies in expectation had on academic outcomes such as test scores and expectations of future academic attainment. Using a multilevel model, the relationship between discrepancies and academic outcomes was evaluated to find if these relationships varied between schools and if they were moderated by a school's level of poverty. Findings indicated that for both actual and perceived discrepancy, the impact of these variables on both test scores and a student' expectation of future academic attainment varied between schools. However, only the relationship between actual discrepancies and the outcome variables (test scores and future expectations) were significantly moderated by school poverty. These finding suggest that between actual and perceived discrepancies in expectations, actual expectations, have the greatest impact on student outcomes.

While this section discussed findings related to the research questions and hypotheses, many interesting findings appeared in the overall analysis. The findings related to main effects

Table 7

Summary of All Hierarchical Linear Models

	Total (ACT) scores	Total (PER) scores	Future (ACT) expectations	Future (PER) expectations
Fixed Effects				
Intercept	148.353***	149.55***	2.956***	2.98***
Discrepancies in exp.	11.134***	4.894***	.271***	.131***
Student expectations	20.263***	16.907***	.61***	.523***
School poverty	-10.811***	-12.326***	-.088**	-.124***
Gender	-3.815***	-4.086***	.076**	.064***
Minority	-12.753***	-12.011***	.051***	.072***

Interactions				
Discrepancies in exp. & student expectations	.427	.185	-.009	-.008
Discrepancies in exp. & school poverty	-4.995***	-1.584	-.08**	-.054
Student expectations & school poverty	-7.228***	-4.951***	-.095***	-.057·
Discrepancies in exp & student expectations & school poverty	2.99***	1.891*	.016	.022
Random Effects				
Intercept	83.899	116.545	.026	.04
Discrepancies in exp.	0.945	9.134	.011	.018

· $p < .1$ *$p < .05$; ** $p < .01$; *** $p < .001$

of gender, minority status, and student expectations, as well as the interaction of student expectations and school poverty. The discussions section of this paper will delve into the impact of these findings, as well as how all the findings from this paper could influence future educational practices and where research on parent expectations should go from here.

Chapter 5: Discussion

The intent of my research was to investigate whether discrepancies in parent expectations (actual and perceived) and student expectations had an impact on student academic outcomes, whether these relationships were impacted by a school's level of poverty, and whether the impact of discrepancies in expectations differed between schools. Grounded in the theory of ecological systems (Bronfenbrenner 1979, 1986, 1992, 2005) the intent was to scrutinize how different levels of a child's ecosystem intertwined to impact future academic outcomes. Fan and Chen (2001) found that parent expectations, of all forms of parent involvement, had the greatest impact on academic outcomes of students. It is for this reason and my observation that expectations of both parent and student develop across many levels of the ecological system that expectations were primary to this research in predicting academic outcomes. Expanding upon the work of Wang and Benner (2014) and McNeal (2014), I specifically examined whether the discrepancies in expectations between students and parents impacted test scores and a student's future expectation of academic achievement.

Review of Research Questions and Hypotheses

Fan and Chen (2001) found that parent expectations are the type of parent involvement that have the greatest impact on children's academic outcomes. With their study as a catalyst of my research and Bronfenbrenner's theory of ecological systems as the conceptual foundation, this study sought to build upon the work of Wang and Benner (2014) by investigating the impact of discrepancies – both real and perceived – in expectations between parents and students. Employing a multilevel model, like that examined by McNeal (2014), I sought to assess whether the impact of parent expectations, and specifically the discrepancies between parent and student expectations, varied between schools and whether this relationship was moderated by school level poverty. This section reviews the questions I posed, the hypotheses that I suggested, and the findings that were revealed by the analyses.

Research Question 1 is whether student expectations predict academic outcomes such as results on standardized tests and future expectations of academic attainment? Within all four models evaluated student expectations had a significant positive relationship with academic outcomes – total test scores and future expectations ($p < .001$; see Table 7). In fact, of all predictor variables, student expectations had the strongest relationship with the outcome variables. These findings confirm my hypothesis that student expectations did in fact have a significant positive relationship with test scores and future expectations.

Research Questions 2 and 3 examined if there was a relationship between discrepancies in expectations – actual and perceived – and standardized test scores. These questions were originally posed by Wang and Benner (2004) and included in my study. My hypotheses, drawn from their findings, were that actual discrepancies would have a positive relationship with test scores and perceived discrepancies would have a negative relationship with test scores. The analysis I ran confirmed the first hypothesis regarding actual discrepancies having a positive relationship with test scores ($p < .001$). However, opposite of Wang and Benner's findings, perceived discrepancies had a significant negative relationship with test scores, failing to confirm my hypothesis ($p < .001$). Wang and Benner, though, only combined Math and Reading scores, whereas I used history, math, reading, and science in my study. Additionally, Wang and Benner used scores from Grade 8 tests, while the tests used in my study were taken in Grade 12. The difference timing of the tests, as well as the specific subjects included, could explain the difference between the two studies. Meaning, a more holistic view of a student's academic performance (all four tests) could have changed the direction of the impact of perceived expectations on student performance. The impact of perceived expectations on test scores could also have strengthened over time from Grade 8 to Grade 12.

Research Question 4 examined whether the relationship between discrepancies in actual expectations and a student's score on standardized tests moderated by a school's poverty level. My hypothesis for this question was that school poverty would moderate the relationship between actual discrepancies in expectations and standardized test scores. Supporting my hypothesis, findings indicated that for students that attended an impoverished school, actual discrepancies in expectations significantly predicted test scores ($p < .001$; see Table 7). For students in non-impoverished schools, actual discrepancies were not related to test scores.

My fifth question related to the relationship between a student's performance on standardized test scores and the perceived discrepancies in expectations. The question posed, is the relationship between perceived discrepancies in expectations and student performance on standardized tests moderated by a school's poverty level? My hypothesis for this question was that the relationship between perceived discrepancies and standardized test scores would be moderated by whether or not a school was considered impoverished.

Findings indicated that school poverty had no interaction effect with perceived discrepancies. This finding fails to support my hypothesis, indicating that there is no significant impact of the interaction of school poverty and perceived expectations on a student's performance on standardized tests.

My sixth Research Question investigated was whether the relationship between actual discrepancies in expectations and a student's future expectations of academic attainment was moderated by a school's poverty level? Like the first question investigating actual discrepancies and test scores, my prediction was that actual discrepancies and a student's expectation of future academic attainment would be moderated by poverty.

The interaction of school poverty and actual discrepancies was found to be significant, confirming my hypothesis ($p < .01$). For a student who attended a school considered to be impoverished, actual discrepancies had a significant relationship with the student's future expectations. For students in a non-impoverished school, actual discrepancies were not related to future expectations.

The final question investigated within this study was, does the relationship between perceived discrepancies in expectations of academic attainment and student's long-term expectations of academic attainment vary by school and is this relationship moderated by a school's poverty level? Like the second question investigating perceived discrepancies and test scores, my prediction was that relationship between perceived discrepancies and a student's expectation of future academic attainment would be moderated by poverty and the relationship of perceived discrepancies and academic outcomes would vary between schools.

My hypothesis was not supported, as the analyses revealed no significant interaction between school poverty and perceived discrepancies with respect to expectations of academic achievement. However, variability between schools in the of the impact of perceived discrepancies on future expectations was found. In this analysis the random effects model, when compared to a fixed effects model, was a significantly better fit ($p < .001$). This finding indicated that the impact of perceived discrepancies on a student's future expectations of academic attainment varied between schools.

To answer Research Question 8, with regards to the impact of actual discrepancies on test scores varying between schools, it was my hypothesis that the impact of actual discrepancies in expectations on standardized test scores would vary by schools. This hypothesis was supported by running an ANOVA comparing a fixed effects model to a random effects model. The findings indicated that the random effects model was the better fit, indicating significant variance between schools on the impact of actual discrepancies on test scores ($p < .001$; see Table 7). Findings for the random effect of actual discrepancies on future expectations were also found to be significant ($p < .001$). This indicated that the impact of the actual discrepancies between students and parents on future expectations varied between schools. Continuing to investigate Research Question 8, the impact of perceived discrepancies on test scores varied across schools. In this analysis the random effects model, when compared to a fixed effects model, was a significantly better fit ($p < .001$). This finding indicated that the impact of perceived discrepancies on a student's performance on standardized tests varied between schools.

Implications of the Findings

The discovery of academic benefits when parents' actual expectations exceed their students' expectations, controlling for all other variables, agrees with Fan and Chen's (2001) finding that parent expectations positively impact student outcomes. It suggests that a student is driven by the reality of her parents' expectations and the parent's involvement that results. For example, if a parent has high expectations for her student the parent is more likely to be involved in the academic life of the child. This involvement can take the form of participating in school events, having one-on-one discussions about academic expectations with her child, checking in with teachers to see how the student is progressing, and investigating future educational opportunities for her child. These activities could serve as the catalyst to a student's own expectations of academic attainment and a student's improved performance at school. On the contrary, if the student holds a higher expectation, particularly with the parent having a relatively low expectation, many of the activities performed by a parent with high expectations would be missing. These omissions could withhold the much-needed incentive and motivation a student needs to gain the confidence to perform well in school.

The finding is important for educators and policy makers as they continue to find ways to level the playing field of education along all socio-economic levels. Parent expectations are malleable. These expectations can be lifted through programs that promote academic success such as PTO family nights, high school prep classes, and college and trade awareness classes. One such program is Readers 2 Leaders in West Dallas. This program not only works with at-risk students on developing reading skills, but also offers classes and workshops for parents to understand why reading is important and the importance education has on the future successes of a parent's children.

Parents possessing high expectations is impactful, as this study has shown, but parent expectations and a how a student perceives her parent's expectations to be are not always identical, indicating that not all students have an accurate view of the expectations their parents have for them. In this study only 43% (n = 8727) of participants had the same perceived expectation as her parent's actual expectation. Of those students who did not have the same perceived expectation as her parent's expectations 18% (n = 4063) perceived her parents' expectations to be lower than her parent's actual expectations and 37% (n = 7370) perceived her parents' expectations to be higher than her parent's actual expectations. For this reason, it is important to note that this study also found that the strength of actual expectations has a stronger relationship to the outcomes studied than do perceived discrepancies. This finding indicates that regardless of what a student perceives her parent's expectations to be, ultimately actual expectations have a stronger impact on the student's academic performance.

The finding that student expectations had a significant impact on academic outcomes, and one that was much stronger than that of discrepancies in expectations, was noteworthy. Too often educators rely on parents who may be working two or three jobs, have not progressed beyond high school, or are just not present in her child's life to be the catalyst for a student's academic performance. The finding that a student's own expectations have a significant impact on a student's performance in school indicates that if school programs at impoverished schools could help to strength a student's own confidence within the classroom, student expectations would rise, and academic performance would improve

On the contrary, it could be theorized that within low-income schools, where parents may not have experienced college, the expectations from home may be quite different than those of parents of children attending a high-income school. The culture expectations of the school would be expected to follow. Even those low-income schools that supply college programs, provide them in such a way to promote attendance and awareness – very different from high-income schools. A program that goes beyond this cultural expectation is Education Opens Doors in Dallas, Texas. The program provides awareness of the college process to middle school students, their teachers, and their parents, effectively raising the expectation of academic attainment of students within all three groups. The findings in this study that student expectations have the strongest practical significance of all variables illuminates the impact that EOD and other programs could have on student outcomes by continuing to raise student expectations. Additionally, by also reaching out to parents, and in theory raising the expectations of parents, the impact of these programs could have significantly positive outcomes.

The school level variable of poverty being a significant negative moderator of test scores and student expectations should be no surprise, but important, nonetheless. Students who attend school that are considered to be low-income or impoverished normally see less resources than those schools in higher-income districts. Even when school funding is equal, a rare occurrence, funds at impoverished schools are usually allocated to help a large number of students who are below acceptable levels in reading and other subjects, leaving little for programs such as those promoting high school and college. In the higher-income schools these monies are disproportionately allocated to extra-curricular programs promoting academic attainment instead of reaching acceptable testing levels. Not only are monies allocated and spent differently between low- and high-income schools, as mentioned previously the cultures of expectations are vastly different. The two phenomena working together could dramatically reduce a low-income student's self-efficacy compared to a similar student attending a high-income school.

While parents' having higher actual expectations than their child was found to have positive effects, the interaction of expectations and poverty had a negative impact on test scores and future expectations, suppressing these effects. In other words, if a student is attending an impoverished school, as discrepancies increase (with the parent having the higher expectation), test scores and future expectations would be expected to decrease. This finding indicates that higher (actual) parent expectations without proper support from the school, as noted earlier, could place undue pressure on students to perform at a lower level than students who attend non-impoverished schools that would be expected to have the necessary support structures in place. Additionally, a student's awareness of what may be available to them can be limited by cultural expectations. For example, within a high-income school system, not only are parents' expectations of academic attainment expected to be higher based on a parent's own educational experience, but the culture of the school system will also reflect this additional expectation. The focus of these school systems is to assist students in attending the best possible college, with programs specifically designed to increase a student's chance at scholarships and acceptance. The effect for the student at the impoverished school is a parent with high expectations, but no resources or expectations of attainment are present at school, suppressing the positive effect of parent expectations.

Finally, the discovery that the impact of discrepancies in expectations – actual and perceived – varies between schools is not only significant but expands upon the work of Wang and Benner (2014). By examining a multilevel model, unlike Wang and Benner, I found that not only are discrepancies significant, but the impact of these discrepancies in expectations differs between schools. This signifies that there are relevant school variables which have a significant impact on expectations and the impact expectations have on student outcomes. These differences could be after-school programs, teachers, school policies, PTO organizations, or access to sports. Additionally, the impact could be related to a school's culture of expectations, as mentioned previously. Teachers and administrators in low-income schools may have a perception of lack of motivation by parents and students, because the teacher's idea of activities related to parent involvement may be related to her middle- to upper-class upbringing. Compounding the effect of low expectations from teachers is the culture of teaching to the lowest denominator. This is where schools in low-income areas are serving students well below grade level on reading and other subjects and schools focus resources on those students due to state mandated goals on standardized testing. The goal of the school becomes to promote success on standardized testing, not college awareness.

Limitations

As there are in any study, my research had its limitations. While the findings of this study are strong and there are many useful applications of these findings, there are areas that could be strengthened to either approach the "best practices" of research or make the application of the findings relevant to a wider range of students. The age of the data, participants limited to only Grade 8, and the lack of weighting of the test scores when combing history, math, reading and science were the main limitations of the study. The remainder of this section will discuss these limitations.

The first limitation of my study was the use of the NELS:88 data set which at the time of completion of this study was over 30 years old. While possibly a concern, the age of the data does not change the fact that the original NELS:88 data set provided a large sample of students across the nation. Recent studies such as those of Wang and Benner (2014) and McNeal (2014) employed the NELS:88 data set and had significant findings with regards to the impact of parent involvement on student outcomes. Furthermore, over the last ten years, research focused on parent expectations continue to show that the relationship between parent expectations and academic outcomes remains positive (Jacobs & Harvey, 2005; Seyfried & Chung, 2002; Benner & Mistry, 2007; Zhang, Haddad, Torres, & Chen, 2011; Froiland, Peterson, & Davidson, 2012). Additionally, the availability of student, parent, and school level data allowed for an ecological view of the impact of expectations on academic outcomes. Given the nature of this study to investigate the impact of parent expectations, and differences in student and parent expectations, the NELS:88 data set provides the richest set of participants, therefore making the data set relevant.

Employing only students in Grade 8 could be perceived as limiting the application of results from this study. A perfect sample, it could be conceived, would allow researchers to look at the impact of expectations on various student outcomes across all ages ranging from pre-K through high school. While data from the NELS:88 sample did not afford the desirable range of participants, the findings uncovered through this study should be encouraging rather than viewed as limited in application. Showing that at late as Grade 8 parent expectations still have an impact on a student's academic outcomes could be seen as a positive. It should be considered encouraging that identifying that parent expectations have an impact on student outcomes of eight graders as these findings could suggest that the earlier the expectations are communicated the greater the impact (Jeynes; 2003, 2005; Froiland, Peterson, & Davidson, 2012; Jacobs & Harvey, 2005).

Combining the test scores was done within my research to understand the impact discrepancies in expectations had on the overall performance of students, and if there was a difference of that effect between students in impoverished and non-impoverished schools. One could argue that weighting of the individual tests would have been a best practice, given that the tests were on slightly different scales. The weighting of each individual test equally would have given equal consideration to a students' ability in history, math, reading and science. By not doing so, different subject areas might have had a different extent of influence on overall achievement score. For example, a student who scores higher in math than in the other three subjects might have the same overall achievement scores as a student who obtains the same scores across all subjects. This leads one to believe that both students performed the same. While it cannot be argued that the "best practices" of research would have been achieved if each individual subject test was weighted, the findings of this research can still be considered valid. First, the scales of the scores were not that different (history 0 to 47, math 0 to 81, reading 0 to 54, and science 0 to 38) as to diminish completely a student's strength in one area or weakness in another. If scales were significantly different, results could be impacted or misinterpreted if a student was very strong in one area in weak in another. Because the scales were not extremely different, this concern is minimized, but not fully alleviated. An important fact, however, is that this research was aimed at investigating the impact of parent expectations on the overall performance of students, not individual subjects. While the overall test score could be skewed based on individual tests not being weighted, the findings are still valid as an overall measurement of student success.

Extending the Research

While the findings within this study are significant and important to expanding our knowledge on the impact of parent expectations, it is also important to note that this research had opened the door to furthering our understanding of how the impact of parent expectations varies in areas such as, among schools, socio-economic statuses, and age of students. The findings in this research should encourage deeper research into uncovering the key variables that might lead to variation in the impact of parent expectations on academic outcomes between schools. In order to investigate the between school variance, future research could examine a multilevel model that investigates discrepancies in expectations in the presence of teacher level variables such as teacher experience, teachers' level of education, number of classes a teacher is expected to teach, and number of students in each class. Additional school level variables that could be examined could be PTO programs offered and participation, stability of school administration, number of extra-curricular programs offered, or average tenure of the professional staff.

A limitation of this study previously discussed was the focus of this study on middle-school students, specifically grade 8. This focus was due in large part, to the fact that the NELS:88 data set only included students who started the study while in eighth grade. While the findings are still significant, future research could examine a similar model used with students of varying ages in the sample. If could be hypothesized that the early expectations are set for students, say kindergarten, the more impactful the influence of the expectations on academic attainment. It could also be argued that the effect of expectations could wear off, a sort of fatigue, if a student is pressed to early in her academic career. It is for this reason future studies should examine the impact of discrepancies in expectations on students in kindergarten or at primary school.

Finally, an area in which this research could be expanded is through a deeper understanding of a student's socio-economic status (SES) and the impact SES has on the relationship between discrepancies in expectations and academic outcomes. My study investigated the impact of poverty on the aforementioned relationship, but poverty was a school level variable. Variables such as parents' level of education, parent employment, and household income could be employed as proxies of a student's SES within a multilevel model.

Summary

My research sought to uncover the impact of parent expectations on a student's academic attainment – specifically discrepancies between parent and student expectations. Through the employment of a multilevel model my research discovered that discrepancies in expectations positively impacted test scores and a student's expectations of academic achievement when a parent's expectations were higher than that of the student. Also discovered was that the school level variable of poverty negatively moderated the impact of discrepancies on academic outcomes. As research continues on how parent expectations impact a student's success in school, it is my hope that findings from this study will inform future educational policy and programs.

References

Agliata, A. K., & Renk, K. (2008). College students' adjustment: The role of parent–college student expectation discrepancies and communication reciprocity. *Journal of Youth and Adolescence, 37*(8), 967. doi: 10.1007/s10964-007-9200-8

Barnard, W. M. (2004). Parent involvement in elementary school and educational attainment. *Children and Youth Services Review, 26*(1), 39-62. doi:10.1016/j.childyouth.2003.11.002

Benner, A. D., & Mistry, R. S. (2007). Congruence of mother and teacher educational expectations and low-income youth's academic competence. *Journal of Educational Psychology*, *99*(1), 140-153. http://psycnet.apa.org/doi/10.1037/0022-0663.99.1.140

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press. http://dx.doi.org/10.1525/aa.1981.83.3.02a00220

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology*, *22*(6), 723. http://psycnet.apa.org /doi/10.1037 /0012-1649.22.6.723

Bronfenbrenner, U. (1992). *Ecological systems theory*. London, England: Jessica Kingsley Publisher. http://dx.doi.org/10.1037/10518-046

Bronfenbrenner, U. (Ed.). (2005). *Making human beings human: Bioecological perspectives on human development*. London, England: Sage.

Brown, J. D., & Madhere, S. (1996, April). Post-secondary achievement: How prepared are our children? Paper presented at the National Black Family Summit, Hilton Head, SC.

Carpenter II, D. M. (2008). Expectations, aspirations, and achievement among Latino students of immigrant families. *Marriage & Family Review*, *43*(1-2), 164-185. http://dx.doi.org/10.1080/01494920802013078

Carreón, G. P., Drake, C., & Barton, A. C. (2005). The importance of presence: Immigrant parents' school engagement experiences. *American Educational Research Journal*, *42*(3), 465-498. http://dx.doi.org/10.3102/00028312042003465

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates Publishing. http://dx.doi.org/10.4324/9780203771587

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155-159. http://dx.doi.org/10.1037//0033-2909.112.1.155

Cotton, K., & Wikelund, K. R. (1989). Parent involvement in education. *School Improvement Research Series*, *6,* 2-18.

Davis-Kean, P. E. (2005). The influence of parent education and family income on child achievement: The indirect role of parental expectations and the home environment. Journal of Family Psychology, 19(2), 294-304. doi: 10.1037/0893-3200.19.2.294

Desimone, L. (1999). Linking parent involvement with student achievement: Do race and income matter? *Journal of Educational Research*, *93*(1), 11-30.

Diagram of Bronfenbrenner's environmental systems. (n.d). Retrieved March 15, 2015, from http://digilence.org/functors-bronfenbrenners-ecological-theorysecret-life-of-bees/

Eagle, E. (1989, March). Socioeconomic status, family structure, and parental involvement: The correlates of achievement. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Eccles, J. S., & Davis-Kean, P. E. (2005). Influences of parents' education on their children's educational attainments: The role of parent and child perceptions. *London Review of Education*, *3*(3), 191-204.

Eccles, J., & Harold, R. (1993). Parent-school involvement during the early adolescent years. *The Teachers College Record*, *94*(3), 568-587.

Eccles, J. S., Jacobs, J. E., & Harold, R. D. (1990). Gender role stereotypes, expectancy effects, and parents' socialization of gender differences. *Journal of Social Issues*, *46*(2), 183-201.

Englund, M. M., Luckner, A. E., Whaley, G. J., & Egeland, B. (2004). Children's achievement in early elementary school: Longitudinal effects of parental involvement, expectations, and quality of assistance. *Journal of Educational Psychology*, *96*(4), 723-730.

Entwisle, D. R., & Baker, D. P. (1983). Gender and young children's expectations for performance in arithmetic. *Developmental Psychology*, *19*(2), 200-209.

Entwisle, D. R., & Hayduk, L. A. (1981). Academic expectations and the school attainment of young children. *Sociology of Education*, *54*(1), 34-50.

Epstein, J. L. (1988a). How do we improve programs for parent involvement? *Educational Horizons*, *66*(2), 58-59.

Epstein, J.L. (1988b). *Parent involvement*. Baltimore: Johns Hopkins University Center for Research on Elementary and Middle Schools.

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

Fehrmann, P. G., Keith, T. Z., & Reimers, T. M. (1987). Home influence on school learning: Direct and indirect effects of parental involvement on high school grades. *Journal of Educational Research*, *80*(6), 330-337.

Froiland, J. M., Peterson, A., & Davison, M. L. (2012). The long-term effects of early parent involvement and parent expectation in the USA. *School Psychology International*, *34*(1), 33-50.

Griffith, J. (1996). Relation of parental involvement, empowerment, and school traits to student academic performance. *The Journal of Educational Research*, *90*(1), 33-41.

Griffith, J. (1997). Linkages of school structural and socio-environmental characteristics to parental satisfaction with public education and student academic achievement. *Journal of Applied Social Psychology*, *27*(2), 156-186.

Griffith, J. (1998). The relation of school structure and social environment to parent involvement in elementary schools. *The Elementary School Journal*, *99*(1), 53-80.

Grolnick, W. S., & Slowiaczek, M. L. (1994). Parents' involvement in children's schooling: A multidimensional conceptualization and motivational model. *Child Development*, *65*(1), 237-252.

Hamilton-Wentworth District School Board. (n.d.). Epstein's six types of parental involvement. Retrieved March 18, 2015, from http://www.hwdsb.on.ca/dundana/school-council/.

Hao, L., & Bonstead-Bruns, M. (1998). Parent-child differences in educational expectations and the academic achievement of immigrant and native students. *Sociology of Education*, *71*(2), 175-198.

Hedges, L. V. (1981). Distribution theory for Glass's estimator of effect size and related estimators. *Journal of Educational and Behavioral Statistics*, *6*(2), 107-128.

Hedges, L. V. (2008). What are effect sizes and why do we need them? *Child Development Perspectives*, *2*(3), 167-171.

Hess, R. D., Holloway, S. D., Dickson, W. P., & Price, G. G. (1984). Maternal variables as predictors of children's school readiness and later achievement in vocabulary and mathematics in sixth grade. *Child Development*, *55*(5), 1902-1912.

Hill, N. E., & Tyson, D. F. (2009). Parental involvement in middle school: A meta-analytic assessment of the strategies that promote achievement. *Developmental Psychology*, *45*(3), 740-763.

Hoover-Dempsey, K. V., Bassler, O. C., & Brissie, J. S. (1987). Parent involvement: Contributions of teacher efficacy, school socioeconomic status, and other school characteristics. *American Educational Research Journal*, *24*(3), 417-435.

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.

Ingels, S. J., Scott, L. A., Taylor, J. R., Owings, J., & Quinn, P. (1998). National education longitudinal study of 1988 (NELS:88) base-year through second follow-up: Final methodology report. Washington, DC: National Center for Education Statistics.

Jacobs, N., & Harvey, D. (2005). Do parents make a difference to children’s academic achievement? Differences between parents of higher and lower achieving students. *Educational Studies*, *31*(4), 431-448.

Jeynes, W. H. (2003). A meta-analysis of the effects of parental involvement on minority children’s academic achievement. *Education and Urban Society*, *35*(2), 202-218.

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

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

Keith, P. B., & Lichtman, M. V. (1994). Does parental involvement influence the academic achievement of Mexican-American eighth graders? Results from the National Education Longitudinal Study. *School Psychology Quarterly*, *9*(4), 256-273.

Keith, T. Z., Keith, P. B., Troutman, G. C., & Bickley, P. G. (1993). Does parental involvement affect eighth-grade student achievement? Structural analysis of national data. *School Psychology Review*, *22*(3), 474-495.

Keith, T. Z., Reimers, T. M., Fehrmann, P. G., Pottebaum, S. M., & Aubey, L. W. (1986). Parental involvement, homework, and TV time: Direct and indirect effects on high school achievement. *Journal of Educational Psychology*, *78*(5), 373-380.

Lopez, G. R., Scribner, J. D., & Mahitivanichcha, K. (2001). Redefining parental involvement: Lessons from high-performing migrant-impacted schools. *American Educational Research Journal*, *38*(2), 253-288.

Marcon, R. A. (1993a, March). At-risk preschoolers: Early predictors of future grade retention. Paper presented at the annual meeting of the Southeastern Psychological Association, Atlanta, GA.

Marcon, R. A. (1993b, March). Parental involvement and early school success: Following the "Class of 2000" at year five. Paper presented at the biennial meeting of the Society for Research in Child Development, New Orleans, LA.

Mattingly, D. J., Prislin, R., McKenzie, T. L., Rodriguez, J. L., & Kayzar, B. (2002). Evaluating evaluations: The case of parent involvement programs. *Review of Educational Research*, *72*(4), 549-576.

McNeal, R. B., Jr. (1999). Parental involvement as social capital: Differential effectiveness on science achievement, truancy, and dropping out. *Social Forces*, *78*(1), 117-144.

McNeal, R. B., Jr. (2014). Parent involvement and student performance: The influence of school context. *Educational Research for Policy and Practice*, 1-15.

No Child Left Behind Act of 2001: Parent involvement, Part A, Subpart 1, U.S.C. § 1118 (2002).

Paulson, S. E. (1994a). Parenting style and parental involvement: Relations with adolescent achievement. *Mid-Western Educational Researcher*, *7*(1), 6-11.

Paulson, S. E. (1994b). Relations of parenting style and parental involvement with ninth-grade students' achievement. *The Journal of Early Adolescence*, *14*(2), 250-267.

Peng, S. S., & Wright, D. (1994). Explanation of academic achievement of Asian American students. *The Journal of Educational Research*, *87*(6), 346-352.

Perreira, K. M., Chapman, M. V., & Stein, G. L. (2006). Becoming an American parent overcoming challenges and finding strength in a new immigrant Latino community. *Journal of Family Issues*, 27(10), 1383-1414.

Phillipson, S., & Phillipson, S. N. (2007). Academic expectations, belief of ability, and involvement by parents as predictors of child achievement: A cross-cultural comparison. *Educational Psychology*, *27*(3), 329-348.

Ramirez, A. F. (2003). Dismay and disappointment: Parental involvement of Latino immigrant parents. *The Urban Review*, *35*(2), 93-110.

Reynolds, A. J. (1992). Comparing measures of parental involvement and their effects on academic achievement. *Early Childhood Research Quarterly*, *7*(3), 441-462.

Rothman, K. J., Greenland, S., & Lash, T. L. (Eds.). (2008). *Modern epidemiology*. Philadelphia, PA: Lippincott Williams & Wilkins.

Seyfried, S. F., & Chung, I. J. (2002). Parent involvement as parental monitoring of student motivation and parent expectations predicting later achievement among African American and European American middle school age students. *Journal of Ethnic and Cultural Diversity in Social Work*, *11*(1-2), 109-131.

Smith, J., Stern, K., & Shatrova, Z. (2008). Factors inhibiting Hispanic parents' school involvement. *Rural Educator*, *29*(*2*), 8-13.

Souto-Manning, M., & Swick, K. J. (2006). Teachers' beliefs about parent and family involvement: Rethinking our family involvement paradigm. *Early Childhood Education Journal*, *34*(*2*), 187-193.

Springer, K. (2009). *Educational research: A contextual approach*. Hoboken, NJ: John Wiley and Sons.

Steinberg, L., Lamborn, S. D., Dornbusch, S. M., & Darling, N. (1992). Impact of parenting practices on adolescent achievement: Authoritative parenting, school involvement, and encouragement to succeed. *Child Development*, *63*(5), 1266-1281.

Stevenson, D. L., & Baker, D. P. (1987). The family-school relation and the child's school performance. *Child Development*, *58*(5), 1348-1357.

Sui-Chu, E. H., & Willms, J. D. (1996). Effects of parental involvement on eighth-grade achievement. *Sociology of Education*, *69*(2), 126-141.

Taylor, R. D. (1996). Adolescents' perceptions of kinship support and family management practices: Association with adolescent adjustment in African American families. *Developmental Psychology*, *32*(4), 687-695.

Taylor, L. C., Hinton, I. D., & Wilson, M. N. (1995). Parental influences on academic performance in African-American students. *Journal of Child and Family Studies*, *4*(3), 293-302.

Uguroglu, M. E., & Walberg, H. J. (1986). Predicting achievement and motivation. *Journal of Research & Development in Education*, *19*(3), 1-12.

Wang, Y., & Benner, A. D. (2014). Parent-Child Discrepancies in Educational Expectations: Differential Effects of Actual versus Perceived Discrepancies. *Child Development*, *85*(3), 891-900. doi: 10.1111/cdev.12171

West, J., Denton, K., & Germino-Hausken, E. (2000). America's kindergartners: Findings from the early childhood longitudinal study, kindergarten class of 1998-99, Fall 1998.

Wood, D., Kaplan, R., & McLoyd, V. C. (2007). Gender differences in the educational expectations of urban, low-income African American youth: The role of parents and the school. *Journal of Youth and Adolescence*, *36*(4), 417-427.

Yan, W., & Lin, Q. (2005). Parent involvement and mathematics achievement: Contrast across racial and ethnic groups. *The Journal of Educational Research*, *99*(2), 116-127.

Yap, K. O., & Enoki, D. Y. (1994, March). In search of the elusive magic bullet: Parent involvement and student outcomes. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Zhang, Y., Haddad, E., Torres, B., & Chen, C. (2011). The reciprocal relationships among parents' expectations, adolescents' expectations, and adolescents' achievement: A two-wave longitudinal analysis of the NELS data. *Journal of Youth and Adolescence*, *40*(4), 479-489.

Appendix A

IRB Exempt Status Determination Application

Southern Methodist University
Institutional Review Board (IRB)
Exempt Status Determination

1920 X 108(

The SMU IRB is required to review and approve all research involving human subjects. This application is intended to help determine if your research project requires further IRB review. Please complete the entire form, and email the signed form and any relevant supporting documents (i.e., grant, protocol, consent forms) to researchcompliance@smu.edu.

PRINCIPAL INVESTIGATOR INFORMATION					
Name (Last, First)	Suhy, Thomas	Position at SMU	PHD Candidate		
Department	Teaching and Learning - Simmons	Email: tsuhy@smu.edu		Phone: 214-909-8542	

PROJECT INFORMATION	
Title	An Ecological Approach: The Impact of Parent Expectations on Student Achievement
Name of funding source	n/a
Grant Number (If Applicable)	n/a
Project Description	I will be using the public data file from of NELS:88 to evaluate if differences in student and parent expectations predict academic outcomes using a mulitlevel model. ALL variables used from the NELS:88 data set are part of the public file.

SECTION I - IS THE ACTIVITY RESEARCH?

Research is a systematic investigation designed to contribute to generalizable knowledge.

Question	Yes	No	Not Sure
Is the intention of the investigation/activity to generate conclusions that can be applied universally, outside of the immediate environment where the investigation/activity will occur?	✔		
Is the activity characterized by order, planning, and methodology?	✔		

If the answer is "yes" to any of the questions, please complete the next section of this form.

If you answered "no" to all of these questions, go to section IV below as your project may not be research. Please sign and submit this form to the IRB. If you are not sure of an answer, please contact the IRB for assistance.

SECTION II – IS THE STUDY CONSIDERED HUMAN SUBJECTS RESEARCH?

A human subject is defined by Federal Regulations as "a living individual about whom an investigator conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information." (45 CFR 46.102(f)(1),(2)).

NOTE: If you are not using living subjects, this is not considered human subjects research.

Question	Yes	No	Not Sure
Does the research involve obtaining information about living individuals?		✔	
Does your study involve any physical procedures, manipulations of the participants, or manipulations of the subject's environment for research purposes?		✔	
Does your study involve any communication between the investigator and the subject? This includes face-to-face, mail, e-mail, and phone interactions as well as other modes of communication.		✔	
Does your study include any information which has been provided for specific purposes by an individual and which the individual can reasonably expect will not be made public (e.g., a health care record)." NOTE: Do not assume information qualifies as "publicly available" just because it has been posted on an electronic website and can be accessed without authorization.		✔	
Does any of your data contain one or more data elements that can be combined with other reasonably available information to identify an individual (e.g., birth date, SSN, e-mail address, etc.)?		✔	

If you answered "yes" to any of the questions, please complete the following section.
If you answered "no" to all of these questions, go to section IV below as your project may not be human subject research. Please sign and submit this form to the IRB.
If you are "not sure" of an answer, please contact the IRB for assistance.

SECTION III - IS YOUR STUDY EXEMPT?

To even be considered as an Exempt study, the research activity must include minimal risk and not include vulnerable populations.

According to Federal Guidelines, Minimal risk means that "the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests" (45 CFR 46.102(i)).

1 Version 4.0

Does your study include activities that would put individuals at more risk than their normal daily life (e.g., extreme ...rtion, asking details about traumatic experiences, identifying aspects of individuals that could create ... in a specific situation) 1920 X 1080	☐	Yes	☐	No	☐	Not Sure
The research may not involve individuals who are cognitively impaired, pregnant women, prisoners, and sometimes children. Does your research focus on any of these classifications?	☐	Yes	☐	No	☐	Not Sure

If you answered "no" to any of the questions, please complete the following section.

If you answered "yes" to any of the above questions, your study is NOT exempt and you will need to complete an Expedited application form located on the Research Compliance

If you are "not sure" of an answer, please contact the IRB for assistance.

☐ **Course-related activities:** The project is limited to course-related activities designed specifically for SMU educational or teaching purposes where data are collected from and about students as part of a routine SMU class exercise or assignment and is not intended for use outside of the classroom.

NOTE: IRB approval is required if a student is involved in an activity designed to teach research methodologies and the instructor or student wishes to conduct further investigation and analyses in order to contribute to scholarly knowledge (e.g. publications, blogs, conferences)

☐ **Journalism/Documentary Activities:** The activities are limited to investigations and interviews that focus on specific events, views, etc., and that lead to publication in any medium (including electronic), documentary production, or are part of training that is explicitly linked to journalism. There is no intent to test a hypothesis.

NOTE: IRB approval may be required when journalists conduct activities normally considered scientific research intended to produce generalizable knowledge (e.g., systematic research, surveys, and/or interviews that are intended to test theories or develop models).

☐ **Oral History:** The project is limited to oral history activities, such as open ended interviews, that only document a specific historical event or the experiences of individuals without the intent to draw conclusions or generalize findings.

NOTE: IRB approval is required when the oral history activities are intended to produce generalizable conclusions (e.g., that serve as data collection intended to test economic, sociological, or anthropological models/theories).

☐ **Program evaluation /Quality Improvement/Quality Assurance Activities:** The project is limited to program evaluation, quality improvement or quality assurance activities designed specifically to assess or improve performance within the department or classroom setting. The intention of the project is not to generate conclusions that can be applied universally, outside of the immediate environment where the project occurred.

Note: Investigators who plan to conduct a QI/QA project, should ensure that they have received approval from any applicable committees within their department or the site in which the activity will occur.

☐ **Public Use Datasets:** The project is limited to analyzing de-identified data contained within a publicly available dataset. Examples of data sources that qualify as non-human subjects research (unless the researcher has received the restricted use data) are the following: Bureau of Labor Statistics (BLS): http://www.bls.gov/; Current Population Survey: http://www.bls.gov/cps/; National Center for Education Statistics (NCES): http://nces.ed.gov/

NOTE: IRB review is required if the publicly available data set contains identifiers, or if the merging of multiple data sets might result in identification of the subjects.

☐ **De-Identified Private Information or Human Biological Specimens:** The project is limited to the use of existing and/or prospectively collected de-identified private information and/or human biological specimens (hereafter referred to as "specimens"). IRB Approval is not required if you can confirm **all** of the following:

- The private information or specimens were/are not collected specifically for the currently proposed research project through an interaction or intervention with living individuals; **AND**
- The investigator can confirm that the use of the private information or specimens is not in violation of the terms of use under which the information or specimens were/will be collected; **AND**
- The investigator will only receive information or specimens that are fully de-identified. De-identified means that the materials to be studied are devoid of any of the 18 Protected Health Information elements set forth in the Privacy Rule, as well as any codes that would enable linkage of the information or specimens to individual identifiers. Note: To be considered de-identified, nobody, including individuals who are not involved in the conduct of the project, should be able to link the information or specimens back to identifiers. **and**
- Specimens are not being used to test the effectiveness of a medical device or as a control in an investigation of an investigational device and the results of the activity are to be submitted to the FDA or held for inspection by the FDA, **and**
- The records/images/charts that are being collected for this study are not from individuals who are or will become recipients of an FDA regulated product (approved or experimental) or act as a control as directed by a research protocol and not by medical practice, and the results are to be submitted to the FDA or held for inspection by the FDA.

SECTION IV - **FORM SUBMISSION**

☑ Attached are any related study documents (i.e., questionnaires, surveys, interview structures)

By submitting this Exempt Status Determination, I certify that the information provided is accurate to the best of my knowledge, and that the research will continue to be conducted ethically and in accordance with Federal guidelines and SMU policies. I will communicate all approved changes to research staff.

Signature

1/2/19

Date

2

Version 4.0

Appendix B

IRB Review Acceptance Letter

Office of Research and Graduate Studies

From: IRB Committee

To: Thomas Suhy

Date: January 4, 2019

Re: **IRB New submission; Protocol #H19-003-SUHT - An Ecological Approach: The Impact of Parent Expectations on Student Achievement**

Dear Mr. Suhy,

Thank you for your submission to research compliance, your attachments will be reviewed. You can next expect to receive a modifications letter with requested modifications (if warranted). Once the modifications, comments to modifications and/or documents are provided, they will be reviewed by the IRB chair and an outcome letter will be provided.

Your study has been assigned the unique ID of H19-003-SUHT. Please use this ID in the subject line of all future correspondence.

Please note: Investigators and key personnel identified in the protocol must complete all required and elective modules within the CITI "Social & Behavioral Research" course with an exam score of 80% or more. NIH training certificates are acceptable as well. We cannot approve your study until all key research personnel have updated training on file. See our instructional video for assistance with CITI registration.

Should you have any questions, please contact the Office of Research and Graduate Studies at 214-768-2033 or at researchcompliance@smu.edu.

Thank You,

IRB Committee Administration

Office of Research and Graduate Studies
Southern Methodist University PO Box 750302 Dallas TX 75275-0240
Office: 214-768-2033 Fax: 214-768-1079

Appendix C

Principal Investigator's Assurance

Southern Methodist University
Institutional Review Board (IRB)
Principal Investigator's Assurance

Project title: An ecological Approach: The Impact of Parent Expectations on Student Achievement.

As Principal Investigator (PI), I have ultimate responsibility for the performance of this study, the protection of the rights and welfare of the human subjects, and strict adherence by all co-investigators and research personnel to all IRB requirements, federal regulations, and state statutes for human subjects research. I hereby assure the following:

The information provided in this application is accurate to the best of my knowledge.

All named individuals on this project have been given a copy of the protocol and have acknowledged an understanding of the procedures outlined in the submission.

All experiments and procedures involving human subjects will be performed under my supervision or that of another qualified professional listed on this protocol.

I understand that, should I use the project described in this application as a basis for a proposal for funding (either intra- or extramural), it is my responsibility to ensure that the description of human subjects use in the funding proposal(s) is identical in principle to that contained in this application. I will submit modifications and/or changes to the IRB as necessary to ensure concordance.

The co-investigators, research personnel, and me, the PI, in this study agree to comply with all applicable requirements for the protection of human subjects in research including, but not limited to, the following:

- Obtaining the legally effective informed consent of all human subjects or their legally authorized representatives, and using only the currently approved consent form with the IRB stamp (if applicable); and
- Obtaining written notification of approval from the IRB before implementation of any changes to the project including adding personnel (except when necessary to eliminate apparent immediate hazards to the subject); and
- Reporting via the Problem Report any unanticipated problems; and
- Promptly providing the IRB with any information requested relative to the project; and
- Promptly and completely complying with an IRB decision to suspend or withdraw its approval from the project; and
- Obtaining continuing review prior to the date approval for this study expires; and
- Granting access to any project-associated records to the IRB to ensure compliance with the approved protocol; and
- Verifying that all research team members are listed on the protocol and have completed CITI training.

Principal Investigator Name: Thom Suhy

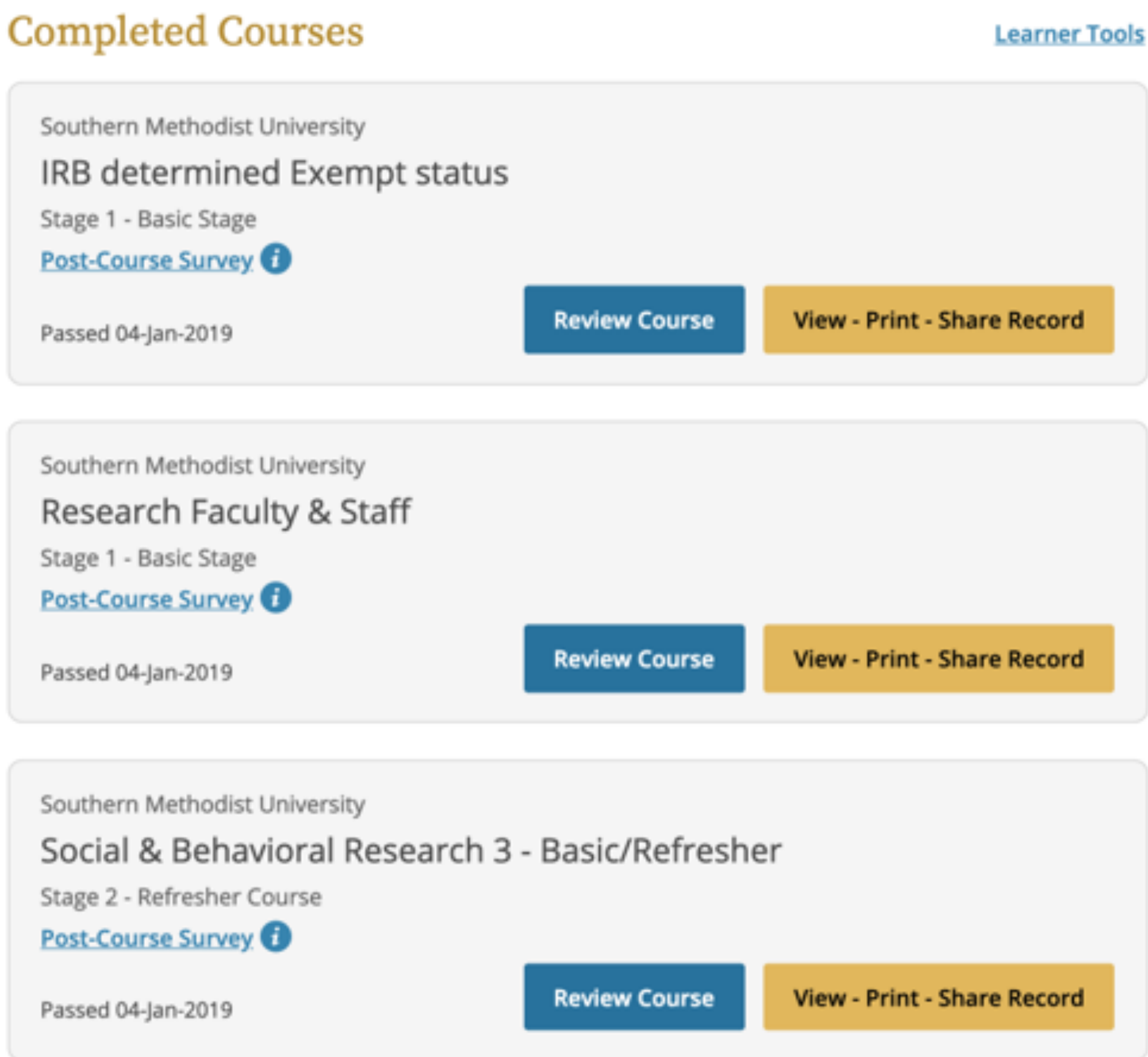
Signature:

Date: 1/8/19

Version 1.0 Aug. 2015

Appendix D

Proof of CITI Course Completion



Appendix E

IRB Approval Letter

From: IRB Committee

To: Thomas Suhy

Date: January 8, 2019

Re: **IRB New Exemption submission Approval; Protocol #H19-003-SUHT – An Ecological Approach: The Impact of Parent Expectations on Student Achievement**

Dear Mr. Suhy,

The IRB Committee, or designee, has completed review of your application and found that it qualified for exemption under the federal guidelines for the protection of human subjects as referenced at Title 45 Part 46.101(b). You are therefore authorized to begin the research as of **01/07/2019**.

Any proposed changes in the protocol should be submitted to the IRB as an amendment prior to initiation (CFR 21 §56.108 (a)(3); §56.108 (a)(4)). Please be advised that as the principal investigator, you are required to report unanticipated adverse events to the Office of Research Administration within 24 hours of the occurrence or upon acknowledgement of the occurrence (CFR 21 § 56.108 (b)(1)).

All investigators and key personnel identified in the protocol must have documented CITI IRB Training on file with this office. Certificates are valid for 3 years from completion date.

Southern Methodist University Office of Research Administration appreciates your continued commitment to the protection of human subjects in research. Should you have questions, or need to report completion of study procedures, please contact Office of Research Administration at 214-768-2033 or at researchcompliance@smu.edu.

Thank You,

Austin Baldwin IRB Chair

Office of Research and Graduate Studies
Southern Methodist University PO Box 750302 Dallas TX 75275-0240
Office: 214-768-2033 Fax: 214-768-1079

Appendix F

R Code Used for Analyses

```
#################### Descriptive Stats NELS:** ##################################
alldata<-read.csv("alldata.csv")
describe(alldata)

#################### Total Scores Actual Expectations ##############################

ScoresAct<-read.csv("testscores_act.csv")
ScoresAct$BYS45C<-ScoresAct$BYS45-mean(ScoresAct$BYS45)
ScoresAct$BYP76C<-ScoresAct$BYP76-mean(ScoresAct$BYP76)
ScoresAct$DIS_ACTEXC<-ScoresAct$DIS_ACTEX-mean(ScoresAct$DIS_ACTEX)

ScoresAct[!complete.cases(ScoresAct),]
describe(ScoresAct, fast=T)
describe(ScoresAct)

table(ScoresAct$RACE)
table(ScoresAct$SEX)
table(ScoresAct$G8LUNCH)

Scores_Act<-lmer(TestScore ~ RACE + SEX + DIS_ACTEXC*BYS45C + DIS_ACTEXC*G8LUNCH +
BYS45C*G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH +
        (1 + DIS_ACTEXC |SCH_ID), data=ScoresAct)
summary(Scores_Act)



Scores_Act2<-lmer(TestScore ~ SEX + RACE + DIS_ACTEXC*BYS45C + DIS_ACTEXC:G8LUNCH +
BYS45C:G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH +
      (1|SCH_ID), data=ScoresAct)
summary(Scores_Act2)

anova(Scores_Act, Scores_Act2)

#################### History Perceived Expectations ##############################
ScoresPer<-read.csv("testscores_per.csv")

ScoresPer$BYS45C<-ScoresPer$BYS45-mean(ScoresPer$BYS45)
ScoresPer$PER_PAREXC<-ScoresPer$PER_PAREX-mean(ScoresPer$PER_PAREX)
ScoresPer$DIS_PEREXC<-ScoresPer$DIS_PEREX-mean(ScoresPer$DIS_PEREX)

ScoresPer[!complete.cases(ScoresPer),]
describe(ScoresPer, fast=T)
describe(ScoresPer)

tablehist(ScoresPer$DIS_PEREXC)

Scores_Per<-lmer(TestScore ~ RACE + SEX + DIS_PEREXC + BYS45C + DIS_PEREXC*BYS45C + G8LUNCH
+ DIS_PEREXC*G8LUNCH + BYS45C*G8LUNCH + BYS45C*DIS_PEREXC*G8LUNCH +
        (1 + DIS_PEREX|SCH_ID), data=ScoresPer)
summary(Scores_Per)
```

```
Scores_Per2<-lmer(TestScore ~ SEX + RACE + DIS_PEREXC + BYS45C + DIS_PEREXC*BYS45C +
G8LUNCH + DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH + BYS45C:DIS_PEREXC:G8LUNCH +
        (1 |SCH_ID), data=ScoresPer)
summary(Scores_Per2)

anova(Scores_Per, Scores_Per2)

#################### Student Future Expectations Actual ###########################
futureexact<-read.csv("future_act.csv")
describe(futureexact)
tabfutureexact

futureexact$BYS45C<-futureexact$BYS45-mean(futureexact$BYS45)
futureexact$BYP76C<-futureexact$BYP76-mean(futureexact$BYP76)
futureexact$DIS_ACTEXC<-futureexact$DIS_ACTEX-mean(futureexact$DIS_ACTEX)

futureexact[!complete.cases(futureexact),]
describe(futureexact, fast=T)

futureexACT<-lmer(F2S43 ~ RACE + SEX + DIS_ACTEXC + BYS45C + DIS_ACTEXC*BYS45C + G8LUNCH
+ DIS_ACTEXC:G8LUNCH + BYS45C:G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH +
       (1 + DIS_ACTEXC|SCH_ID), data=futureexact)
summary(futureexACT)

futureexACT2<-lmer(F2S43 ~ RACE + SEX + DIS_ACTEXC + BYS45C + DIS_ACTEXC*BYS45C +
G8LUNCH + DIS_ACTEXC:G8LUNCH + BYS45C:G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH +
(1|SCH_ID), data=futureexact)
summary(futureexACT2)

anova(futureexACT, futureexACT2)

####################Student's Future Expectations Perceived  ########################
futureexper<-read.csv("future_per.csv")
describe(futureexper)
futureexper

futureexper$BYS45C<-futureexper$BYS45-mean(futureexper$BYS45)
futureexper$PER_PAREXC<-futureexper$PER_PAREX-mean(futureexper$PER_PAREX)
futureexper$DIS_PEREXC<-futureexper$DIS_PEREX-mean(futureexper$DIS_PEREX)

futureexper[!complete.cases(futureexper),]
describe(futureexper, fast=T)

futureexPER<-lmer(F2S43 ~ RACE + SEX + DIS_PEREXC + BYS45C + DIS_PEREXC*BYS45C + G8LUNCH
+ DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH + BYS45C:DIS_PEREXC:G8LUNCH +
       (1 + DIS_PEREXC|SCH_ID), data=futureexper)
summary(futureexPER)

futureexPER2<-lmer(F2S43 ~ SEX + RACE + DIS_PEREXC + BYS45C + DIS_PEREXC*BYS45C + G8LUNCH
+ DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH + BYS45C:DIS_PEREXC:G8LUNCH + (1|SCH_ID),
data=futureexper)
summary(futureexPER2)

anova(futureexPER, futureexPER2)
```

Appendix G

R Code Output

```
SCH_ID   (Intercept) 113.3    10.64
 Residual             675.9    26.00   > library(lme4)
Loading required package: Matrix

Attaching package: 'Matrix'

The following object is masked from 'package:tidyr':

    expand

> library(lmerTest)

Attaching package: 'lmerTest'

The following object is masked from 'package:lme4':

    lmer

The following object is masked from 'package:stats':

    step

> #library(plyr)
> #library(car)
> #library(nlme)
> #library(FSA)
>
> ### Thom's Mac
> setwd("~/Dropbox/Dissertation 2019 - GHD/Final Dissertation Data Files")
>

> alldata<-read.csv("alldata.csv")
>
> describe(alldata)
          vars     n       mean         sd     median   trimmed        mad       min        max      range  skew kurtosis       se
STU_ID       1 22511 4610406.81 2619378.36 4590025.00 4680035.72 3388138.34 124902.00 9199197.00 9074295.00 -0.19    -1.44 17458.26
SCH_ID       2 22511   46103.57   26193.78   45900.00   46799.86   33880.38   1249.00   91991.00   90742.00 -0.19    -1.44   174.58
BYS45        3 22335       2.82       0.96       3.00       2.91       1.48      0.00       4.00       4.00 -0.61    -0.15     0.01
BYS48A       4 18890       3.00       0.87       3.00       3.09       1.48      0.00       4.00       4.00 -0.84     0.64     0.01
BYS48B       5 19700       3.01       0.86       3.00       3.10       1.48      0.00       4.00       4.00 -0.83     0.66     0.01
PER_PAREX    6 20174       3.00       0.84       3.00       3.08       0.74      0.00       4.00       4.00 -0.81     0.63     0.01
DIS_PEREX    7 20160       0.14       0.79       0.00       0.12       0.00     -4.00       4.00       8.00  0.56     3.67     0.01
BYP76        8 22511       2.71       0.97       3.00       2.77       1.48      0.00       4.00       4.00 -0.31    -0.73     0.01
DIS_ACTEX    9 22335      -0.10       0.95       0.00      -0.08       1.48     -4.00       4.00       8.00 -0.13     0.91     0.01
G8LUNCH     10 22105       0.14       0.35       0.00       0.05       0.00      0.00       1.00       1.00  2.09     2.38     0.00
SEX         11 22511       0.50       0.50       1.00       0.50       0.00      0.00       1.00       1.00 -0.01    -2.00     0.00
RACE        12 22275       0.31       0.46       0.00       0.27       0.00      0.00       1.00       1.00  0.80    -1.35     0.00
F22XRIRR    13 12250      33.50      10.22      34.80      33.91      11.98     10.41      50.89      40.48 -0.31    -0.97     0.09
F22XMIRR    14 12251      49.15      14.63      49.80      49.36      17.54     16.77      78.10      61.33 -0.11    -0.98     0.13
F22XSIRR    15 12172      23.71       6.28      23.84      23.79       7.64     10.03      35.96      25.93 -0.08    -1.01     0.06
F22XHIRR    16 12117      35.04       5.43      35.05      35.14       6.46     20.72      45.38      24.66 -0.12    -0.88     0.05
TESTSCORE   17 12071     141.59      33.16     142.78     142.24      39.35     61.73     209.24     147.51 -0.14    -0.95     0.30
F2S43       18 13340       3.01       0.91       3.00       3.08       1.48      0.00       4.00       4.00 -0.50    -0.59     0.01
>
> ################### Total Scores Actual Expectations ########################################
>
> ScoresAct<-read.csv("testscores_act.csv")
>
> ScoresAct$BYS45C<-ScoresAct$BYS45-mean(ScoresAct$BYS45)
> ScoresAct$BYP76C<-ScoresAct$BYP76-mean(ScoresAct$BYP76)
> ScoresAct$DIS_ACTEXC<-ScoresAct$DIS_ACTEX-mean(ScoresAct$DIS_ACTEX)
>
> ScoresAct[!complete.cases(ScoresAct),]
 [1] STU_ID     SCH_ID     BYS45      BYP76      DIS_ACTEX  G8LUNCH    SEX        RACE       F22XRIRR   F22XMIRR   F22XSIRR   F22XHIRR
TestScore  BYS45C     BYP76C     DIS_ACTEXC
<0 rows> (or 0-length row.names)
> describe(ScoresAct, fast=T)
           vars     n       mean         sd       min        max      range       se
STU_ID        1 11710 4628399.85 2672260.11 124902.00 9199197.00 9074295.00 24694.50
SCH_ID        2 11710   46283.51   26722.60   1249.00   91991.00   90742.00   246.95
BYS45         3 11710       2.88       0.92      0.00       4.00       4.00     0.01
BYP76         4 11710       2.77       0.94      0.00       4.00       4.00     0.01
DIS_ACTEX     5 11710      -0.11       0.90     -4.00       4.00       8.00     0.01
G8LUNCH       6 11710       0.11       0.32      0.00       1.00       1.00     0.00
SEX           7 11710       0.50       0.50      0.00       1.00       1.00     0.00
RACE          8 11710       0.26       0.44      0.00       1.00       1.00     0.00
F22XRIRR      9 11710      33.67      10.16     10.41      50.89      40.48     0.09
F22XMIRR     10 11710      49.40      14.57     16.77      78.10      61.33     0.13
F22XSIRR     11 11710      23.79       6.27     10.03      35.96      25.93     0.06
F22XHIRR     12 11710      35.09       5.42     20.72      45.38      24.66     0.05
TestScore    13 11710     141.95      33.06     64.06     209.24     145.18     0.31
BYS45C       14 11710       0.00       0.92     -2.88       1.12       4.00     0.01
BYP76C       15 11710       0.00       0.94     -2.77       1.23       4.00     0.01
DIS_ACTEXC   16 11710       0.00       0.90     -3.89       4.11       8.00     0.01
> describe(ScoresAct)
           vars     n       mean         sd     median   trimmed        mad       min        max      range  skew kurtosis       se
STU_ID        1 11710 4628399.85 2672260.11 4598168.00 4699942.19 3410528.56 124902.00 9199197.00 9074295.00 -0.20    -1.50 24694.50
SCH_ID        2 11710   46283.51   26722.60   45981.00   46998.93   34105.73   1249.00   91991.00   90742.00 -0.20    -1.50   246.95
BYS45         3 11710       2.88       0.92       3.00       2.97       1.48      0.00       4.00       4.00 -0.64    -0.03     0.01
BYP76         4 11710       2.77       0.94       3.00       2.84       1.48      0.00       4.00       4.00 -0.37    -0.64     0.01
DIS_ACTEX     5 11710      -0.11       0.90       0.00      -0.09       0.00     -4.00       4.00       8.00 -0.21     0.98     0.01
G8LUNCH       6 11710       0.11       0.32       0.00       0.02       0.00      0.00       1.00       1.00  2.46     4.04     0.00
SEX           7 11710       0.50       0.50       1.00       0.51       0.00      0.00       1.00       1.00 -0.02    -2.00     0.00
RACE          8 11710       0.26       0.44       0.00       0.21       0.00      0.00       1.00       1.00  1.07    -0.85     0.00
F22XRIRR      9 11710      33.67      10.16      35.06      34.10      11.82     10.41      50.89      40.48 -0.32    -0.95     0.09
```

```
F22XMIRR     10 11710      49.40      14.57      50.05      49.63      17.35      16.77      78.10      61.33 -0.12    -0.97      0.13
F22XSIRR     11 11710      23.79       6.27      23.93      23.89       7.61      10.03      35.96      25.93 -0.10    -1.00      0.06
F22XHIRR     12 11710      35.09       5.42      35.13      35.20       6.45      20.72      45.38      24.66 -0.13    -0.88      0.05
TestScore    13 11710     141.95      33.06     143.15     142.63      39.12      64.06     209.24     145.18 -0.14    -0.94      0.31
BYS45C       14 11710       0.00       0.92       0.12       0.09       1.48      -2.88       1.12       4.00 -0.64    -0.03      0.01
BYP76C       15 11710       0.00       0.94       0.23       0.07       1.48      -2.77       1.23       4.00 -0.37    -0.64      0.01
DIS_ACTEXC   16 11710       0.00       0.90       0.11       0.02       0.00      -3.89       4.11       8.00 -0.21     0.98      0.01

   0    1
8618 3092
> table(ScoresAct$SEX)

   0    1
5800 5910
> table(ScoresAct$G8LUNCH)

    0     1
10396  1314
>
> Scores_Act<-lmer(TestScore ~ RACE + SEX + DIS_ACTEXC*BYS45C + DIS_ACTEXC*G8LUNCH + BYS45C*G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH +
+                    (1 + DIS_ACTEXC |SCH_ID), data=ScoresAct)
>
> summary(Scores_Act)
Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']
Formula: TestScore ~ RACE + SEX + DIS_ACTEXC * BYS45C + DIS_ACTEXC * G8LUNCH +      BYS45C * G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH + (1 +
DIS_ACTEXC |      SCH_ID)
   Data: ScoresAct

REML criterion at convergence: 109583.5

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.2923 -0.6773  0.0381  0.7092  3.6016

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 SCH_ID   (Intercept)  83.5989  9.143
          DIS_ACTEXC    0.9448  0.972   -0.44
 Residual             630.2185 25.104
Number of obs: 11710, groups:  SCH_ID, 945

Fixed effects:
                            Estimate Std. Error         df t value Pr(>|t|)
(Intercept)                 148.3533     0.5142  1655.9916 288.490  < 2e-16 ***
RACE                        -12.7526     0.6394  9852.9877 -19.946  < 2e-16 ***
SEX                          -3.8153     0.4819 11501.6977  -7.918 2.64e-15 ***
DIS_ACTEXC                   11.1337     0.3359  1045.1643  33.146  < 2e-16 ***
BYS45C                       20.2627     0.3446 11548.7064  58.793  < 2e-16 ***
G8LUNCH                     -10.8111     1.2740  1271.6458  -8.486  < 2e-16 ***
DIS_ACTEXC:BYS45C             0.4273     0.2881  4576.4881   1.483    0.138
DIS_ACTEXC:G8LUNCH           -4.9949     0.8738   814.7867  -5.717 1.53e-08 ***
BYS45C:G8LUNCH               -7.2282     0.9374 11655.8391  -7.711 1.35e-14 ***
DIS_ACTEXC:BYS45C:G8LUNCH     2.9897     0.6936  5742.0102   4.310 1.66e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
                  (Intr) RACE   SEX    DIS_ACTEXC BYS45C G8LUNC DIS_ACTEXC:BYS45C DIS_ACTEXC:G BYS45C:
RACE              -0.266
SEX               -0.471 -0.017
DIS_ACTEXC        -0.039 -0.035  0.021
BYS45C            -0.036 -0.040 -0.040  0.477
G8LUNCH           -0.225 -0.227  0.007  0.024      0.035
DIS_ACTEXC:BYS45C  0.196  0.051 -0.008  0.001     -0.227 -0.095
DIS_ACTEXC:G       0.027 -0.006 -0.021 -0.384     -0.182  0.051 -0.001
BYS45C:G8LU        0.030  0.002 -0.014 -0.176     -0.366  0.078  0.083             0.512
DIS_ACTEXC:BYS45C: -0.086 -0.010  0.007 -0.001      0.094  0.271 -0.415             0.065       -0.199
>
>
>
> Scores_Act2<-lmer(TestScore ~ SEX + RACE + DIS_ACTEXC*BYS45C + DIS_ACTEXC:G8LUNCH + BYS45C:G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH +
+              (1|SCH_ID), data=ScoresAct)
> summary(Scores_Act2)
Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']
Formula: TestScore ~ SEX + RACE + DIS_ACTEXC * BYS45C + DIS_ACTEXC:G8LUNCH +      BYS45C:G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH + (1 | SCH_ID)
   Data: ScoresAct

REML criterion at convergence: 109657.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.2888 -0.6821  0.0396  0.7092  3.6515

Random effects:
 Groups   Name        Variance Std.Dev.
 SCH_ID   (Intercept)  91.88    9.586
 Residual             631.92   25.138
Number of obs: 11710, groups:  SCH_ID, 945

Fixed effects:
                            Estimate Std. Error         df t value Pr(>|t|)
(Intercept)                 147.3092     0.5114  1781.2066 288.077  < 2e-16 ***
SEX                          -3.7752     0.4828 11474.8194  -7.819 5.80e-15 ***
RACE                        -13.8824     0.6273  9100.3880 -22.131  < 2e-16 ***
DIS_ACTEXC                   11.1462     0.3339 11647.7796  33.381  < 2e-16 ***
BYS45C                       20.2867     0.3457 11609.4394  58.686  < 2e-16 ***
DIS_ACTEXC:BYS45C             0.1751     0.2868 11434.1449   0.611    0.541
DIS_ACTEXC:G8LUNCH           -4.3554     0.8647 11623.8957  -5.037 4.80e-07 ***
BYS45C:G8LUNCH               -6.5755     0.9375 11691.9052  -7.014 2.44e-12 ***
DIS_ACTEXC:BYS45C:G8LUNCH     4.5579     0.6688 11666.7602   6.815 9.88e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
```

```
                   (Intr) SEX    RACE   DIS_ACTEXC BYS45C DIS_ACTEXC:BYS45C DIS_ACTEXC:G BYS45C:
SEX               -0.473
RACE              -0.331 -0.016
DIS_ACTEXC        -0.005  0.020 -0.032
BYS45C            -0.027 -0.041 -0.032  0.481
DIS_ACTEXC:BYS45C  0.176 -0.007  0.032 -0.001     -0.221
DIS_ACTEXC:G       0.035 -0.022  0.014 -0.387     -0.188  0.008
BYS45C:G8LU        0.048 -0.014  0.020 -0.179     -0.370  0.089             0.515
DIS_ACTEXC:BYS45C: -0.025  0.006  0.052 -0.003      0.086 -0.406             0.041       -0.226
>
> anova(Scores_Act, Scores_Act2)
refitting model(s) with ML (instead of REML)
Data: ScoresAct
Models:
Scores_Act2: TestScore ~ SEX + RACE + DIS_ACTEXC * BYS45C + DIS_ACTEXC:G8LUNCH +
Scores_Act2:     BYS45C:G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH + (1 | SCH_ID)
Scores_Act: TestScore ~ RACE + SEX + DIS_ACTEXC * BYS45C + DIS_ACTEXC * G8LUNCH +
Scores_Act:     BYS45C * G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH + (1 + DIS_ACTEXC |
Scores_Act:     SCH_ID)
            Df    AIC    BIC logLik deviance  Chisq Chi Df Pr(>Chisq)
Scores_Act2 11 109683 109764 -54830   109661
Scores_Act  14 109617 109720 -54794   109589 72.006      3  1.587e-15 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> ScoresPer<-read.csv("testscores_per.csv")
>
> ScoresPer$BYS45C<-ScoresPer$BYS45-mean(ScoresPer$BYS45)
> ScoresPer$PER_PAREXC<-ScoresPer$PER_PAREX-mean(ScoresPer$PER_PAREX)
> ScoresPer$DIS_PEREXC<-ScoresPer$DIS_PEREX-mean(ScoresPer$DIS_PEREX)
> describe(ScoresPer, fast=T)
           vars     n       mean         sd       min        max      range       se
STU_ID        1 10643 4625086.94 2673789.26 124902.00 9199197.00 9074295.00 25917.62
SCH_ID        2 10643   46250.38   26737.89   1249.00   91991.00   90742.00   259.18
BYS45         3 10643       2.92       0.89      0.00       4.00       4.00     0.01
BYS48A        4 10049       3.03       0.82      0.00       4.00       4.00     0.01
BYS48B        5 10425       3.05       0.81      0.00       4.00       4.00     0.01
PER_PAREX     6 10643       3.03       0.79      0.00       4.00       4.00     0.01
DIS_PEREX     7 10643       0.11       0.74     -4.00       4.00       8.00     0.01
G8LUNCH       8 10643       0.11       0.31      0.00       1.00       1.00     0.00
SEX           9 10643       0.51       0.50      0.00       1.00       1.00     0.00
RACE         10 10643       0.26       0.44      0.00       1.00       1.00     0.00
F22XRIRR     11 10643      34.09      10.09     10.41      50.89      40.48     0.10
F22XMIRR     12 10643      50.07      14.49     16.77      78.10      61.33     0.14
F22XSIRR     13 10643      24.03       6.25     10.03      35.96      25.93     0.06
F22XHIRR     14 10643      35.31       5.40     20.72      45.38      24.66     0.05
TestScore    15 10643     143.50      32.84     64.06     209.24     145.18     0.32
BYS45C       16 10643       0.00       0.89     -2.92       1.08       4.00     0.01
PER_PAREXC   17 10643       0.00       0.79     -3.03       0.97       4.00     0.01
DIS_PEREXC   18 10643       0.00       0.74     -4.11       3.89       8.00     0.01
> describe(ScoresPer)
           vars     n       mean         sd     median   trimmed        mad       min        max      range  skew kurtosis       se
STU_ID        1 10643 4625086.94 2673789.26 4598576.00 4695522.69 3503091.73 124902.00 9199197.00 9074295.00 -0.20    -1.50 25917.62
SCH_ID        2 10643   46250.38   26737.89   45985.00   46954.74   35030.87   1249.00   91991.00   90742.00 -0.20    -1.50   259.18
BYS45         3 10643       2.92       0.89       3.00       3.00       1.48      0.00       4.00       4.00 -0.66     0.08     0.01
BYS48A        4 10049       3.03       0.82       3.00       3.11       0.00      0.00       4.00       4.00 -0.81     0.78     0.01
BYS48B        5 10425       3.05       0.81       3.00       3.12       0.00      0.00       4.00       4.00 -0.81     0.84     0.01
PER_PAREX     6 10643       3.03       0.79       3.00       3.10       0.74      0.00       4.00       4.00 -0.79     0.79     0.01
DIS_PEREX     7 10643       0.11       0.74       0.00       0.09       0.00     -4.00       4.00       8.00  0.61     3.87     0.01
G8LUNCH       8 10643       0.11       0.31       0.00       0.01       0.00      0.00       1.00       1.00  2.53     4.42     0.00
SEX           9 10643       0.51       0.50       1.00       0.51       0.00      0.00       1.00       1.00 -0.03    -2.00     0.00
RACE         10 10643       0.26       0.44       0.00       0.20       0.00      0.00       1.00       1.00  1.12    -0.75     0.00
F22XRIRR     11 10643      34.09      10.09      35.58      34.58      11.50     10.41      50.89      40.48 -0.37    -0.89     0.10
F22XMIRR     12 10643      50.07      14.49      50.86      50.39      17.12     16.77      78.10      61.33 -0.17    -0.95     0.14
F22XSIRR     13 10643      24.03       6.25      24.25      24.16       7.53     10.03      35.96      25.93 -0.14    -0.98     0.06
F22XHIRR     14 10643      35.31       5.40      35.43      35.44       6.43     20.72      45.38      24.66 -0.16    -0.87     0.05
TestScore    15 10643     143.50      32.84     145.26     144.36      38.76     64.06     209.24     145.18 -0.19    -0.92     0.32
BYS45C       16 10643       0.00       0.89       0.08       0.08       1.48     -2.92       1.08       4.00 -0.66     0.08     0.01
PER_PAREXC   17 10643       0.00       0.79      -0.03       0.07       0.74     -3.03       0.97       4.00 -0.79     0.79     0.01
DIS_PEREXC   18 10643       0.00       0.74      -0.11      -0.02       0.00     -4.11       3.89       8.00  0.61     3.87     0.01
> Scores_Per<-lmer(TestScore ~ RACE + SEX + DIS_PEREXC + BYS45C + DIS_PEREXC*BYS45C + G8LUNCH + DIS_PEREXC*G8LUNCH + BYS45C*G8LUNCH +
BYS45C*DIS_PEREXC*G8LUNCH +
+                   (1 + DIS_PEREX|SCH_ID), data=ScoresPer)
> summary(Scores_Per)
Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']
Formula: TestScore ~ RACE + SEX + DIS_PEREXC + BYS45C + DIS_PEREXC * BYS45C +      G8LUNCH + DIS_PEREXC * G8LUNCH + BYS45C * G8LUNCH + BYS45C
*
    DIS_PEREXC * G8LUNCH + (1 + DIS_PEREX | SCH_ID)
   Data: ScoresPer

REML criterion at convergence: 100468.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.1295 -0.6706  0.0392  0.7073  3.0254

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 SCH_ID   (Intercept) 116.545  10.796
          DIS_PEREX     9.134   3.022   -0.56
 Residual             671.480  25.913
Number of obs: 10643, groups:  SCH_ID, 944

Fixed effects:
                            Estimate Std. Error         df t value Pr(>|t|)
(Intercept)                 149.5574     0.5756  1587.7092 259.826  < 2e-16 ***
RACE                        -12.0105     0.7060  9148.3872 -17.012  < 2e-16 ***
SEX                          -4.0860     0.5252 10388.2242  -7.779 7.98e-15 ***
DIS_PEREXC                    4.8944     0.5097  1520.8875   9.603  < 2e-16 ***
BYS45C                       16.9067     0.3920 10555.7760  43.133  < 2e-16 ***
G8LUNCH                     -12.3257     1.4313  1225.9453  -8.611  < 2e-16 ***
DIS_PEREXC:BYS45C             0.1852     0.3318  2020.2673   0.558   0.5768
DIS_PEREXC:G8LUNCH           -1.5836     1.3217   813.3305  -1.198   0.2312
BYS45C:G8LUNCH               -4.9509     1.0977 10499.6760  -4.510 6.55e-06 ***
DIS_PEREXC:BYS45C:G8LUNCH     1.8911     0.8401  2140.0716   2.251   0.0245 *
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
                   (Intr) RACE   SEX    DIS_PEREXC BYS45C G8LUNC DIS_PEREXC:BYS45C DIS_PEREXC:G BYS45C:
RACE               -0.264
SEX                -0.457 -0.016
DIS_PEREXC          0.001 -0.028 -0.014
BYS45C              0.009 -0.038 -0.062  0.468
G8LUNCH            -0.228 -0.221  0.000  0.011      0.021
DIS_PEREXC:BYS45C   0.191  0.026  0.002  0.341     -0.095 -0.086
DIS_PEREXC:G        0.008 -0.010 -0.002 -0.385     -0.179 -0.006 -0.132
BYS45C:G8LU         0.013 -0.002 -0.003 -0.166     -0.355  0.052  0.033             0.439
DIS_PEREXC:BYS45C: -0.077 -0.001 -0.004 -0.135      0.037  0.234 -0.395             0.405       -0.153
>
>
> Scores_Per2<-lmer(TestScore ~ SEX + RACE + DIS_PEREXC + BYS45C + DIS_PEREXC*BYS45C + G8LUNCH + DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH +
BYS45C:DIS_PEREXC:G8LUNCH +
+                    (1 |SCH_ID), data=ScoresPer)
> summary(Scores_Per2)
Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']
Formula: TestScore ~ SEX + RACE + DIS_PEREXC + BYS45C + DIS_PEREXC * BYS45C +      G8LUNCH + DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH +
BYS45C:DIS_PEREXC:G8LUNCH +      (1 | SCH_ID)
   Data: ScoresPer

REML criterion at convergence: 100483.5

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.1102 -0.6721  0.0427  0.7135  3.1549

Random effects:
 Groups   Name        Variance Std.Dev.

Number of obs: 10643, groups:  SCH_ID, 944

Fixed effects:
                          Estimate Std. Error        df t value Pr(>|t|)
(Intercept)              1.496e+02  5.768e-01  1.598e+03 259.289  < 2e-16 ***
SEX                     -4.095e+00  5.258e-01  1.040e+04  -7.789 7.41e-15 ***
RACE                    -1.209e+01  7.083e-01  9.404e+03 -17.066  < 2e-16 ***
DIS_PEREXC               5.067e+00  4.916e-01  1.031e+04  10.307  < 2e-16 ***
BYS45C                   1.700e+01  3.915e-01  1.062e+04  43.419  < 2e-16 ***
G8LUNCH                 -1.238e+01  1.433e+00  1.237e+03  -8.638  < 2e-16 ***
DIS_PEREXC:BYS45C       -1.945e-02  3.262e-01  1.030e+04  -0.060   0.9525
DIS_PEREXC:G8LUNCH      -1.778e+00  1.252e+00  1.038e+04  -1.420   0.1557
BYS45C:G8LUNCH          -5.005e+00  1.096e+00  1.052e+04  -4.565 5.04e-06 ***
DIS_PEREXC:BYS45C:G8LUNCH  1.925e+00  8.224e-01  1.038e+04   2.341   0.0193 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
                   (Intr) SEX    RACE   DIS_PEREXC BYS45C G8LUNC DIS_PEREXC:BYS45C DIS_PEREXC:G BYS45C:
SEX                -0.457
RACE               -0.264 -0.017
DIS_PEREXC          0.084 -0.014 -0.029
BYS45C              0.009 -0.062 -0.036  0.480
G8LUNCH            -0.229  0.000 -0.221 -0.021      0.020
DIS_PEREXC:BYS45C   0.193  0.003  0.026  0.349     -0.087 -0.087
DIS_PEREXC:G       -0.024 -0.002 -0.009 -0.392     -0.187  0.089 -0.138
BYS45C:G8LU         0.012 -0.004 -0.001 -0.171     -0.355  0.052  0.031             0.456
DIS_PEREXC:BYS45C: -0.077 -0.005 -0.001 -0.139      0.034  0.238 -0.396             0.399       -0.156
>
> anova(Scores_Per, Scores_Per2)
refitting model(s) with ML (instead of REML)
Data: ScoresPer
Models:
Scores_Per2: TestScore ~ SEX + RACE + DIS_PEREXC + BYS45C + DIS_PEREXC * BYS45C +
Scores_Per2:     G8LUNCH + DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH + BYS45C:DIS_PEREXC:G8LUNCH +
Scores_Per2:     (1 | SCH_ID)
Scores_Per: TestScore ~ RACE + SEX + DIS_PEREXC + BYS45C + DIS_PEREXC * BYS45C +
Scores_Per:     G8LUNCH + DIS_PEREXC * G8LUNCH + BYS45C * G8LUNCH + BYS45C *
Scores_Per:     DIS_PEREXC * G8LUNCH + (1 + DIS_PEREX | SCH_ID)
            Df    AIC    BIC logLik deviance  Chisq Chi Df Pr(>Chisq)
Scores_Per2 12 100516 100603 -50246   100492
Scores_Per  14 100506 100607 -50239   100478 14.476      2  0.0007186 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> futureexact<-read.csv("future_act.csv")
> describe(futureexact)
          vars     n       mean         sd  median    trimmed        mad    min     max   range  skew kurtosis       se
STU_ID       1 12954 4657154.78 2652781.62 4598578 4734366.34 3404938.42 124902 9199197 9074295 -0.22    -1.46 23307.71
SCH_ID       2 12954   46571.05   26527.82   45985   47343.17   34049.39   1249   91991   90742 -0.22    -1.46   233.08
BYS45        3 12954       2.94       0.88       3       3.02       1.48      0       4       4 -0.66     0.06     0.01
BYP76        4 12954       2.83       0.91       3       2.90       1.48      0       4       4 -0.40    -0.60     0.01
DIS_ACTEX    5 12954      -0.11       0.89       0      -0.09       0.00     -4       4       8 -0.21     1.03     0.01
G8LUNCH      6 12954       0.11       0.31       0       0.01       0.00      0       1       1  2.56     4.56     0.00
SEX          7 12954       0.51       0.50       1       0.52       0.00      0       1       1 -0.05    -2.00     0.00
RACE         8 12954       0.26       0.44       0       0.20       0.00      0       1       1  1.08    -0.84     0.00
F2S43        9 12954       3.01       0.91       3       3.08       1.48      0       4       4 -0.50    -0.60     0.01
> futureexact$BYS45C<-futureexact$BYS45-mean(futureexact$BYS45)
> futureexact$BYP76C<-futureexact$BYP76-mean(futureexact$BYP76)
> futureexact$DIS_ACTEXC<-futureexact$DIS_ACTEX-mean(futureexact$DIS_ACTEX)
>
> futureexact[!complete.cases(futureexact),]
 [1] STU_ID     SCH_ID     BYS45      BYP76      DIS_ACTEX  G8LUNCH    SEX        RACE       F2S43      BYS45C     BYP76C     DIS_ACTEXC
<0 rows> (or 0-length row.names)
> describe(futureexact, fast=T)
           vars     n       mean         sd       min        max   range       se
STU_ID        1 12954 4657154.78 2652781.62 124902.00 9199197.00 9074295 23307.71
SCH_ID        2 12954   46571.05   26527.82   1249.00   91991.00   90742   233.08
BYS45         3 12954       2.94       0.88      0.00       4.00       4     0.01
BYP76         4 12954       2.83       0.91      0.00       4.00       4     0.01
DIS_ACTEX     5 12954      -0.11       0.89     -4.00       4.00       8     0.01
```

```
G8LUNCH       6 12954       0.11       0.31      0.00       1.00       1     0.00
SEX           7 12954       0.51       0.50      0.00       1.00       1     0.00
RACE          8 12954       0.26       0.44      0.00       1.00       1     0.00
F2S43         9 12954       3.01       0.91      0.00       4.00       4     0.01
BYS45C       10 12954       0.00       0.88     -2.94       1.06       4     0.01
BYP76C       11 12954       0.00       0.91     -2.83       1.17       4     0.01
DIS_ACTEXC   12 12954       0.00       0.89     -3.89       4.11       8     0.01
>
> futureexACT<-lmer(F2S43 ~ RACE + SEX + DIS_ACTEXC + BYS45C + DIS_ACTEXC*BYS45C + G8LUNCH + DIS_ACTEXC:G8LUNCH + BYS45C:G8LUNCH +
BYS45C:DIS_ACTEXC:G8LUNCH +
+             (1 + DIS_ACTEXC|SCH_ID), data=futureexact)
> summary(futureexACT)
Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']
Formula: F2S43 ~ RACE + SEX + DIS_ACTEXC + BYS45C + DIS_ACTEXC * BYS45C +      G8LUNCH + DIS_ACTEXC:G8LUNCH + BYS45C:G8LUNCH +
BYS45C:DIS_ACTEXC:G8LUNCH +      (1 + DIS_ACTEXC | SCH_ID)
   Data: futureexact

REML criterion at convergence: 29654.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-5.0683 -0.6353  0.0445  0.6920  3.2232

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 SCH_ID   (Intercept) 0.02554  0.1598
          DIS_ACTEXC  0.01076  0.1037   -0.09
 Residual             0.54807  0.7403
Number of obs: 12954, groups:  SCH_ID, 956

Fixed effects:
                            Estimate Std. Error         df t value Pr(>|t|)
(Intercept)                2.956e+00  1.229e-02  2.062e+03 240.523  < 2e-16 ***
RACE                       5.123e-02  1.697e-02  8.276e+03   3.019 0.002544 **
SEX                        7.558e-02  1.339e-02  1.291e+04   5.644 1.69e-08 ***
DIS_ACTEXC                 2.706e-01  1.012e-02  1.073e+03  26.739  < 2e-16 ***
BYS45C                     6.095e-01  9.723e-03  1.160e+04  62.689  < 2e-16 ***
G8LUNCH                   -8.829e-02  2.989e-02  1.536e+03  -2.954 0.003184 **
DIS_ACTEXC:BYS45C         -9.676e-03  8.390e-03  6.238e+03  -1.153 0.248803
DIS_ACTEXC:G8LUNCH        -8.015e-02  2.732e-02  1.022e+03  -2.934 0.003422 **
BYS45C:G8LUNCH            -9.451e-02  2.769e-02  1.274e+04  -3.413 0.000645 ***
DIS_ACTEXC:BYS45C:G8LUNCH  1.608e-02  2.093e-02  6.784e+03   0.769 0.442197
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
                   (Intr) RACE   SEX    DIS_ACTEXC BYS45C G8LUNC DIS_ACTEXC:BYS45C DIS_ACTEXC:G BYS45C:
RACE               -0.286
SEX                -0.555 -0.014
DIS_ACTEXC         -0.022 -0.039  0.025
BYS45C             -0.038 -0.044 -0.033  0.432
G8LUNCH            -0.174 -0.258  0.001  0.018      0.040
DIS_ACTEXC:BYS45C   0.223  0.050  0.004  0.010     -0.232 -0.112
DIS_ACTEXC:G        0.014  0.004 -0.014 -0.370     -0.159  0.084 -0.004
BYS45C:G8LU         0.027  0.006 -0.008 -0.152     -0.350  0.095  0.081             0.464
DIS_ACTEXC:BYS45C: -0.089 -0.019 -0.003 -0.004      0.093  0.326 -0.401             0.087       -0.197
>
> futureexACT2<-lmer(F2S43 ~ RACE + SEX + DIS_ACTEXC + BYS45C + DIS_ACTEXC*BYS45C + G8LUNCH + DIS_ACTEXC:G8LUNCH + BYS45C:G8LUNCH +
BYS45C:DIS_ACTEXC:G8LUNCH + (1|SCH_ID), data=futureexact)
> summary(futureexACT2)
Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']
Formula: F2S43 ~ RACE + SEX + DIS_ACTEXC + BYS45C + DIS_ACTEXC * BYS45C +      G8LUNCH + DIS_ACTEXC:G8LUNCH + BYS45C:G8LUNCH +
BYS45C:DIS_ACTEXC:G8LUNCH +      (1 | SCH_ID)
   Data: futureexact

REML criterion at convergence: 29674.7

Scaled residuals:
    Min      1Q  Median      3Q     Max
-5.0280 -0.6371  0.0443  0.6976  3.2643

Random effects:
 Groups   Name        Variance Std.Dev.
 SCH_ID   (Intercept) 0.02592  0.1610
 Residual             0.55626  0.7458
Number of obs: 12954, groups:  SCH_ID, 956

Fixed effects:
                            Estimate Std. Error         df t value Pr(>|t|)
(Intercept)                2.955e+00  1.232e-02  2.061e+03 239.902  < 2e-16 ***
RACE                       5.148e-02  1.698e-02  8.313e+03   3.032 0.002441 **
SEX                        7.580e-02  1.341e-02  1.293e+04   5.654  1.6e-08 ***
DIS_ACTEXC                 2.704e-01  9.273e-03  1.284e+04  29.158  < 2e-16 ***
BYS45C                     6.079e-01  9.746e-03  1.172e+04  62.372  < 2e-16 ***
G8LUNCH                   -8.736e-02  2.994e-02  1.532e+03  -2.917 0.003580 **
DIS_ACTEXC:BYS45C         -9.162e-03  8.142e-03  1.287e+04  -1.125 0.260479
DIS_ACTEXC:G8LUNCH        -7.954e-02  2.493e-02  1.292e+04  -3.191 0.001422 **
BYS45C:G8LUNCH            -9.314e-02  2.775e-02  1.280e+04  -3.357 0.000791 ***
DIS_ACTEXC:BYS45C:G8LUNCH  1.366e-02  2.034e-02  1.289e+04   0.672 0.501747
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
                   (Intr) RACE   SEX    DIS_ACTEXC BYS45C G8LUNC DIS_ACTEXC:BYS45C DIS_ACTEXC:G BYS45C:
RACE               -0.286
SEX                -0.554 -0.014
DIS_ACTEXC         -0.004 -0.041  0.026
BYS45C             -0.037 -0.043 -0.033  0.473
G8LUNCH            -0.175 -0.258  0.001  0.011      0.039
DIS_ACTEXC:BYS45C   0.222  0.053  0.005  0.007     -0.234 -0.113
DIS_ACTEXC:G        0.007  0.005 -0.015 -0.372     -0.175  0.113 -0.003
BYS45C:G8LU         0.026  0.006 -0.007 -0.166     -0.350  0.095  0.082             0.509
DIS_ACTEXC:BYS45C: -0.089 -0.019 -0.004 -0.003      0.094  0.326 -0.400             0.081       -0.200
>
```

```
> anova(futureexACT, futureexACT2)
refitting model(s) with ML (instead of REML)
Data: futureexact
Models:
futureexACT2: F2S43 ~ RACE + SEX + DIS_ACTEXC + BYS45C + DIS_ACTEXC * BYS45C +
futureexACT2:     G8LUNCH + DIS_ACTEXC:G8LUNCH + BYS45C:G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH +
futureexACT2:     (1 | SCH_ID)
futureexACT: F2S43 ~ RACE + SEX + DIS_ACTEXC + BYS45C + DIS_ACTEXC * BYS45C +
futureexACT:     G8LUNCH + DIS_ACTEXC:G8LUNCH + BYS45C:G8LUNCH + BYS45C:DIS_ACTEXC:G8LUNCH +
futureexACT:     (1 + DIS_ACTEXC | SCH_ID)
             Df   AIC   BIC logLik deviance  Chisq Chi Df Pr(>Chisq)
futureexACT2 12 29632 29721 -14804    29608
futureexACT  14 29616 29721 -14794    29588 19.346      2  6.296e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> futureexper<-read.csv("future_per.csv")
> describe(futureexper)
          vars     n       mean         sd  median    trimmed        mad    min     max   range  skew kurtosis       se
STU_ID       1 11859 4649861.65 2655493.59 4599412 4724845.35 3406396.56 124902 9199197 9074295 -0.21    -1.47 24384.91
SCH_ID       2 11859   46498.12   26554.94   45994   47247.96   34062.74   1249   91991   90742 -0.21    -1.47   243.85
BYS45        3 11859       2.97       0.86       3       3.05       1.48      0       4       4 -0.68     0.16     0.01
BYS48A       4 11240       3.07       0.80       3       3.15       0.00      0       4       4 -0.84     0.91     0.01
BYS48B       5 11619       3.08       0.79       3       3.15       0.00      0       4       4 -0.81     0.88     0.01
PER_PAREX    6 11859       3.06       0.77       3       3.14       0.74      0       4       4 -0.81     0.90     0.01
DIS_PEREX    7 11859       0.09       0.72       0       0.08       0.00     -4       4       8  0.53     4.14     0.01
G8LUNCH      8 11859       0.10       0.30       0       0.00       0.00      0       1       1  2.65     5.03     0.00
SEX          9 11859       0.51       0.50       1       0.52       0.00      0       1       1 -0.05    -2.00     0.00
RACE        10 11859       0.25       0.44       0       0.19       0.00      0       1       1  1.12    -0.74     0.00
F2S43       11 11859       3.03       0.90       3       3.10       1.48      0       4       4 -0.53    -0.54     0.01
> futureexper$BYS45C<-futureexper$BYS45-mean(futureexper$BYS45)
> futureexper$PER_PAREXC<-futureexper$PER_PAREX-mean(futureexper$PER_PAREX)
> futureexper$DIS_PEREXC<-futureexper$DIS_PEREX-mean(futureexper$DIS_PEREX)
> > describe(futureexper, fast=T)
           vars     n       mean         sd       min        max   range       se
STU_ID        1 11859 4649861.65 2655493.59 124902.00 9199197.00 9074295 24384.91
SCH_ID        2 11859   46498.12   26554.94   1249.00   91991.00   90742   243.85
BYS45         3 11859       2.97       0.86      0.00       4.00       4     0.01
BYS48A        4 11240       3.07       0.80      0.00       4.00       4     0.01
BYS48B        5 11619       3.08       0.79      0.00       4.00       4     0.01
PER_PAREX     6 11859       3.06       0.77      0.00       4.00       4     0.01
DIS_PEREX     7 11859       0.09       0.72     -4.00       4.00       8     0.01
G8LUNCH       8 11859       0.10       0.30      0.00       1.00       1     0.00
SEX           9 11859       0.51       0.50      0.00       1.00       1     0.00
RACE         10 11859       0.25       0.44      0.00       1.00       1     0.00
F2S43        11 11859       3.03       0.90      0.00       4.00       4     0.01
BYS45C       12 11859       0.00       0.86     -2.97       1.03       4     0.01
PER_PAREXC   13 11859       0.00       0.77     -3.06       0.94       4     0.01
DIS_PEREXC   14 11859       0.00       0.72     -4.09       3.91       8     0.01
>
> futureexPER<-lmer(F2S43 ~ RACE + SEX + DIS_PEREXC + BYS45C + DIS_PEREXC*BYS45C + G8LUNCH + DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH +
BYS45C:DIS_PEREXC:G8LUNCH +
+               (1 + DIS_PEREXC|SCH_ID), data=futureexper)
> summary(futureexPER)
Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']
Formula: F2S43 ~ RACE + SEX + DIS_PEREXC + BYS45C + DIS_PEREXC * BYS45C +      G8LUNCH + DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH +
BYS45C:DIS_PEREXC:G8LUNCH +      (1 + DIS_PEREXC | SCH_ID)
   Data: futureexper

REML criterion at convergence: 27670.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.9228 -0.6443  0.0644  0.6821  2.9651

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 SCH_ID   (Intercept) 0.04041  0.2010
          DIS_PEREXC  0.01778  0.1333   -0.03
 Residual             0.56433  0.7512
Number of obs: 11859, groups:  SCH_ID, 955

Fixed effects:
                           Estimate Std. Error         df t value Pr(>|t|)
(Intercept)               2.980e+00  1.363e-02  1.976e+03 218.672  < 2e-16 ***
RACE                      6.387e-02  1.848e-02  8.673e+03   3.456 0.000551 ***
SEX                       7.194e-02  1.428e-02  1.176e+04   5.037  4.8e-07 ***
DIS_PEREXC                1.307e-01  1.460e-02  1.394e+03   8.956  < 2e-16 ***
BYS45C                    5.231e-01  1.078e-02  1.154e+04  48.540  < 2e-16 ***
G8LUNCH                  -1.241e-01  3.337e-02  1.487e+03  -3.719 0.000207 ***
DIS_PEREXC:BYS45C        -7.798e-03  9.682e-03  2.782e+03  -0.805 0.420636
DIS_PEREXC:G8LUNCH       -5.391e-02  3.922e-02  9.640e+02  -1.375 0.169605
BYS45C:G8LUNCH           -5.724e-02  3.114e-02  1.179e+04  -1.838 0.066074 .
DIS_PEREXC:BYS45C:G8LUNCH -2.244e-02  2.590e-02  2.453e+03  -0.866 0.386351
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
                   (Intr) RACE   SEX    DIS_PEREXC BYS45C G8LUNC DIS_PEREXC:BYS45C DIS_PEREXC:G BYS45C:
RACE               -0.284
SEX                -0.532 -0.013
DIS_PEREXC          0.078 -0.029 -0.008
BYS45C              0.013 -0.037 -0.054  0.445
G8LUNCH            -0.183 -0.248 -0.006 -0.019      0.021
DIS_PEREXC:BYS45C   0.207  0.031  0.008  0.304     -0.088 -0.097
DIS_PEREXC:G       -0.022 -0.010  0.001 -0.372     -0.165  0.082 -0.114
BYS45C:G8LU         0.009  0.000  0.001 -0.153     -0.345  0.060  0.030             0.399
DIS_PEREXC:BYS45C: -0.076 -0.010 -0.006 -0.114      0.033  0.267 -0.374             0.384       -0.166
>
>
> futureexPER2<-lmer(F2S43 ~ SEX + RACE + DIS_PEREXC + BYS45C + DIS_PEREXC*BYS45C + G8LUNCH + DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH +
BYS45C:DIS_PEREXC:G8LUNCH + (1|SCH_ID), data=futureexper)
> summary(futureexPER2)
Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']
```

```
Formula: F2S43 ~ SEX + RACE + DIS_PEREXC + BYS45C + DIS_PEREXC * BYS45C +      G8LUNCH + DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH +
BYS45C:DIS_PEREXC:G8LUNCH +      (1 | SCH_ID)
   Data: futureexper

REML criterion at convergence: 27691.6

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.8873 -0.6488  0.0639  0.6908  3.2272

Random effects:
 Groups   Name        Variance Std.Dev.
 SCH_ID   (Intercept) 0.0406   0.2015
 Residual             0.5733   0.7572
Number of obs: 11859, groups:  SCH_ID, 955

Fixed effects:
                            Estimate Std. Error         df t value Pr(>|t|)
(Intercept)                2.980e+00  1.365e-02  1.981e+03 218.258  < 2e-16 ***
SEX                        7.158e-02  1.431e-02  1.179e+04   5.003 5.72e-07 ***
RACE                       6.387e-02  1.850e-02  8.676e+03   3.453 0.000557 ***
DIS_PEREXC                 1.322e-01  1.352e-02  1.174e+04   9.772  < 2e-16 ***
BYS45C                     5.237e-01  1.079e-02  1.169e+04  48.526  < 2e-16 ***
G8LUNCH                   -1.231e-01  3.341e-02  1.491e+03  -3.683 0.000239 ***
DIS_PEREXC:BYS45C         -6.306e-03  9.151e-03  1.166e+04  -0.689 0.490773
DIS_PEREXC:G8LUNCH        -4.927e-02  3.548e-02  1.177e+04  -1.389 0.164880
BYS45C:G8LUNCH            -5.650e-02  3.115e-02  1.184e+04  -1.814 0.069693 .
DIS_PEREXC:BYS45C:G8LUNCH -1.886e-02  2.430e-02  1.168e+04  -0.776 0.437521
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
                   (Intr) SEX    RACE   DIS_PEREXC BYS45C G8LUNC DIS_PEREXC:BYS45C DIS_PEREXC:G BYS45C:
SEX                -0.532
RACE               -0.284 -0.013
DIS_PEREXC          0.090 -0.008 -0.030
BYS45C              0.013 -0.054 -0.036  0.475
G8LUNCH            -0.183 -0.006 -0.248 -0.024      0.020
DIS_PEREXC:BYS45C   0.207  0.009  0.034  0.332     -0.095 -0.099
DIS_PEREXC:G       -0.026 -0.001 -0.009 -0.381     -0.180  0.093 -0.127
BYS45C:G8LU         0.009  0.001  0.000 -0.164     -0.345  0.062  0.032             0.432
DIS_PEREXC:BYS45C: -0.076 -0.010 -0.009 -0.125      0.036  0.271 -0.377             0.386       -0.179
>
> anova(futureexPER, futureexPER2)
refitting model(s) with ML (instead of REML)
Data: futureexper
Models:
futureexPER2: F2S43 ~ SEX + RACE + DIS_PEREXC + BYS45C + DIS_PEREXC * BYS45C +
futureexPER2:     G8LUNCH + DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH + BYS45C:DIS_PEREXC:G8LUNCH +
futureexPER2:     (1 | SCH_ID)
futureexPER: F2S43 ~ RACE + SEX + DIS_PEREXC + BYS45C + DIS_PEREXC * BYS45C +
futureexPER:     G8LUNCH + DIS_PEREXC:G8LUNCH + BYS45C:G8LUNCH + BYS45C:DIS_PEREXC:G8LUNCH +
futureexPER:     (1 + DIS_PEREXC | SCH_ID)
             Df   AIC   BIC logLik deviance  Chisq Chi Df Pr(>Chisq)
futureexPER2 12 27652 27740 -13814    27628
futureexPER  14 27636 27739 -13804    27608 20.137      2   4.24e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```