AUTONOMIC AROUSAL AND ITS RELATIONSHIP TO CHILD BEHAVIOR: THE MODERATING ROLE OF PARENTING PRACTICES

by

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A DISSERTATION

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ABSTRACT

Moderated multiple regression analyses were conducted in order to examine parental involvement, poor monitoring and supervision, and inconsistent discipline as moderators in the relationship between autonomic arousal (i.e., baseline skin conductance level, baseline respiratory sinus arrhythmia, skin conductance reactivity, respiratory sinus arrhythmia reactivity) and externalizing behavior. Data was collected from a sample of 360 fourth grade students identified by their teachers and parents as at-risk for moderate to high levels of aggression. The results did not support the research hypotheses posed in the current study. Despite the lack of significant results for the planned hypotheses, exploratory analyses produced useful findings about the complex relationships among these behavioral, physiological, and contextual constructs. Five predictor variables (i.e., parental involvement, poor monitoring and supervision, inconsistent discipline, gender, and RSA reactivity) predicted parent rated externalizing behavior, while gender was the single predictor of teacher rated externalizing behavior. This provided a unique look into how the predictor variables manifest themselves in different environments. Further, this study highlighted the main effects of sympathetic and parasympathetic functioning, which suggest that at-risk preadolescents are maladaptively regulated. For example, higher RSA reactivity indicated that at-risk youth have inflexible parasympathetic responding, which negates sympathetic activation. This main effect of RSA reactivity demonstrates that parasympathetic functioning predicts child behavior over sympathetic functioning in an at risk sample of children. Additionally, physiological response patterns in at-risk children appear to be more convoluted than originally suggested. The current

study found higher levels of baseline RSA to be associated with higher ratings of teacher rated hyperactivity in the presence of high inconsistent discipline. This suggests that externalizing behaviors may not be entirely characterized by a single pattern of autonomic arousal (e.g. low baseline). Overall, these results confirm the influence of bioecological interactions on externalizing behavior in an at-risk sample of children and point to a nuanced and complicated picture of the maintenance of externalizing behaviors. This study highlighted relationships among the study variables that will serve to contribute to future research, treatment, and prevention of externalizing behavior in at-risk children.

DEDICATION

To my family and closest friends for your support and encouragement, I would not have been able to complete this without you.

LIST OF ABBREVIATIONS AND SYMBOLS

α	Cronbach's alpha, a measure of internal consistency
B	Unstandardized regression coefficients
CI	Confidence interval: proportion of intervals that contain the true value of the parameter
df	Degrees of freedom: number of values free to vary after certain restrictions have been placed on the data
F	Fisher's F ratio: A ration of two variances
M	Mean: the sum of a set of measurements divided by the number of measurements in the set
MSE	Mean squared error
N	Sample size
p	Probability associated with the occurrence under the null hypothesis of a value as extreme as or more extreme than the observed value
r	Pearson correlation
R^2	Squared multiple correlation coefficient, fraction of the variability of the response that is fitted by the model
SD	Standard deviation: amount of variation or dispersion of a set of data values
SE B	Standard error of the regression coefficients
t	Computed value of t test
=	Equal to
<	Less than

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CHAPTER I

INTRODUCTION

Externalizing behavior problems in childhood include aggressive behaviors, impulsivity and hyperactivity, and delinquency. It is well established in the literature that externalizing behaviors can be highly impairing to children and families. These behaviors can persist and manifest in adulthood, have poor prognoses, and are associated with considerable costs to society (Erford, Bardhoshi, Ross, Gunther, & Duncan, 2017). Externalizing behaviors are associated with a range of concurrent outcomes across the lifespan, including incarceration, unemployment, relationship problems, substance use, and the intergenerational transmission of violence (Broidy et al., 2003). Further, these behaviors are major risk factors for peer relationship difficulties, poor adjustment, academic underachievement, depressive symptoms, later juvenile delinquency, substance abuse, antisocial behavior, adult crime, and violence (Baker, Grant, & Morlock, 2008; Deater-Deckard, Dodge, Bates, & Pettit, 1998; Erford et al., 2017; Hinshaw, 1992; Reef, Diamantopoulou, van Meurs, Verhulst, & van der Ende, 2011; Tremblay, Nagin, Seguin, Zoccolillo, Zelazo, Boivin, Perusse, & Japel, 2004).

For the purposes of this study, externalizing behaviors will be characterized by the following behaviors: aggression, conduct problems, and hyperactivity. These externalizing behaviors are evident in a range of disorders that are prevalent in childhood and may persist into adolescence and even adulthood (American Psychiatric Association (APA), 2013; Burt, Krueger, McGue, & Iacono, 2003).

The Centers for Disease Control and Prevention's National Health and Nutrition Examination Survey (2012) reported the prevalence rate for any type of mental illness in children and adolescents aged 8 to 15 was 13%, of which 10% were reported to have a behavior (i.e., attention-deficit/hyperactivity disorder) or conduct disorder. Despite these high rates of mental illness in children, only 1 in every 5 children who have mental health problems will receive treatment (Department of Health and Human Services, 1999). Further, research indicates that children who evidence externalizing behaviors and do not receive intervention, will have an increased risk of adult psychopathology (Erford et al., 2017; Meany-Walen, Kottman, Bullis, & Taylor, 2014; Reef et al., 2011).

Statement of Problem

While it is clear that certain children will exhibit externalizing behaviors problems, it is more challenging to predict which children will develop these behavioral problems and therefore which children should be targeted for intervention. The solution may lie in determining which characteristics and factors predispose children to these types of behavior. For instance, children who are at highest risk and who do not learn how to properly regulate their behavior during early life are often characterized by a large number of key biological and environmental factors (Tremblay et al., 2004). Two particularly important types of risk factors are those that are associated with environmental (i.e., parenting) and biological (i.e., autonomic arousal) risk factors. Previous research suggests that parenting styles and practices are predictive of childhood symptomatology and later life psychopathology (Frick & Muñoz, 2006; Linver, Brooks-Gunn, & Kohen, 2002). Other studies have also demonstrated significant relationships between autonomic arousal and externalizing behaviors (Lorber, 2004). However, little research has looked at individual differences within the child on these relations. As such, the current

study will examine key child specific, sociocultural, environmental, and biological risk factors that have been found to predispose children to externalizing behaviors in an at-risk sample of preadolescent children.

Significance of Study

The overarching goal of this study is to facilitate a better understanding of externalizing behaviors in childhood. Specifically, this study focused on two constructs that have been individually linked to externalizing behavior problems in children, namely autonomic arousal and parenting practices. There is a paucity of research concerning the influence of parent-child interaction factors on the relationship between autonomic arousal and externalizing behaviors. Although autonomic arousal and parenting factors have been studied in relation to externalizing behaviors in general populations of children (Erath, El-Sheikh, and Cummings, 2009; Erath, El-Sheikh, Hinnant, & Cummings, 2011; Kochanska, Brock, Chen, Aksan, & Anderson, 2015), these variables have not been examined simultaneously in populations that are more vulnerable to development of these behavior problems. Therefore, the current study focuses on a sample of at-risk children who have demonstrated moderate to high levels of aggressive behaviors. Cross sectional data utilized in this study were drawn from a randomized controlled trial examining the relative effectiveness of a cognitive behavioral intervention program (Lochman, Wells, & Lenhart, 2008).

By looking within this particular sample, one can explore possible individual differences; which could have implications for tailoring interventions. Further, the findings from this study will have the potential to impact helping professionals who work with children with externalizing behavior issues. Targeting the potential factors that are most likely to result in the most severe externalizing behaviors may promote generalizability of significant factors to a

population that is most likely to present for counseling services. Furthermore, given the consequences of externalizing behavior problems in childhood, we can better identify and develop appropriate prevention strategies and interventions by targeting children based on their levels of risk and identifying the pathways by which such behavior is influenced and sustained.

Statement of Purpose

The purpose of this quantitative study is to enrich knowledge by examining inconsistent discipline, parental involvement, and poor monitoring and supervision as moderators in the relationship between autonomic arousal and externalizing behaviors in an at-risk sample of children (See Figure 1). Although the effect of parenting practices on this relationship is the primary aim of this study, this study also intends to further explore how these relationships differ for males versus females and family income levels, because these variables lack research focus. Therefore, secondary analyses to the current study will explore a double moderation model in order to examine gender and yearly income level as additional moderators of this relationship (See Figure 2). While the effects of autonomic arousal and parenting on one another are likely reciprocal, parenting variables were chosen as the moderator in order to represent a model of environmental risk factors (i.e., parenting) acting on biological risk factors (i.e., autonomic arousal).

Theoretical/Conceptual Framework

The conceptual and statistical models of moderation for this study are based on properties of the bioecological systems theory (Bronfenbrenner, 1994). The bioecological systems theory posits that the quality of interaction within the child's proximal environment is most influential to the child's development (Bronfenbrenner, 1994). More specifically, as explained in

Bronfenbrenner's (2001) later work, human development occurs from the interactions between an individual (biological being) and the interconnected systems surrounding them (ecology).

Central to the current study is the notion that there are certain children who are more at-risk for externalizing behavior problems that are likely to persist into later life. Bronfenbrenner's model of development specifically addresses the prospect that processes of development may function differently in different ecological niches, as well as the fact that different individuals may be differentially affected by the same experiences. Though this more recent version of Bronfenbrenner's ecological model is deliberate in acknowledging the biological aspects of the individual, there is a lack of depth regarding biological components of development. Jay Belsky (1997) also found this point to be a criticism and a weakness of the bioecological model. Belsky argues that environmental influence on children's biological functioning is important when thinking about behavioral functioning. In his research, he emphasized individual differences in susceptibility to parenting influences, where some individuals are less susceptible to parental influence due to biological factors, while others have traits that are more plastic and susceptible to parenting influences (Belsky, 1997).

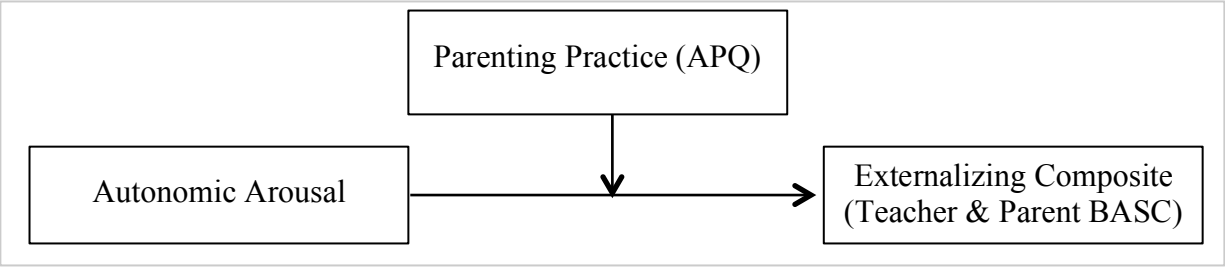

Figure 1: Conceptual Model for Moderation within Primary Hypotheses

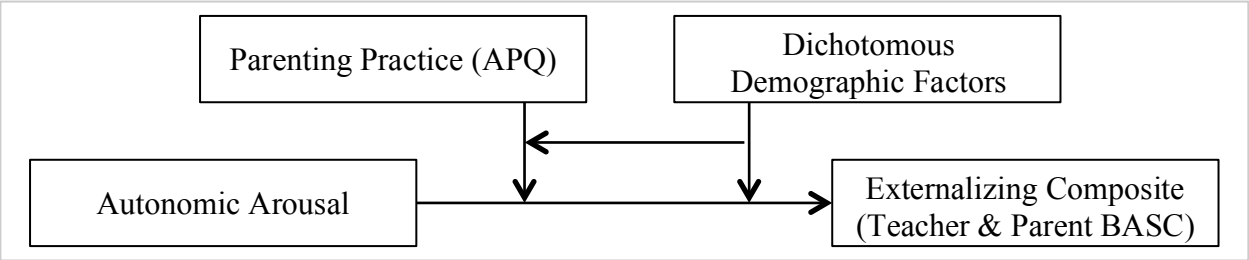

Figure 2: Conceptual Model for Double Moderation within Secondary Analyses

Research Questions

The following research questions were addressed:

1. Does parenting practice affect the relationship between baseline SCL and externalizing behaviors in children?
2. Does parenting practice affect the relationship between baseline RSA and externalizing behaviors in children?
3. Does parenting practice affect the relationship between SCL reactivity and externalizing behaviors in children?
4. Does parenting practice affect the relationship between RSA reactivity and externalizing behaviors in children?

Hypotheses

The following hypotheses were tested:

1a. In the presence of high inconsistent discipline there, will be a significant negative relationship between baseline SCL and externalizing behaviors in children.

1b. In the presence of low parental involvement there, will be a significant negative relationship between baseline SCL and externalizing behaviors in children.

1c. In the presence of poor parental monitoring, there will be a significant negative relationship between baseline SCL and externalizing behaviors in children.

2a. In the presence of high inconsistent discipline there, will be a significant negative relationship between baseline RSA and externalizing behaviors in children.

2b. In the presence of low parental involvement there, will be a significant negative relationship between baseline RSA and externalizing behaviors in children.

2c. In the presence of poor parental monitoring, there will be a significant negative relationship between baseline RSA and externalizing behaviors in children.

3a. In the presence of high inconsistent discipline there, will be a significant positive relationship between SCL reactivity and externalizing behaviors in children.

3b. In the presence of low parental involvement there, will be a significant positive relationship between SCL reactivity and externalizing behaviors in children.

3c. In the presence of poor parental monitoring, there will be a significant positive relationship between SCL reactivity and externalizing behaviors in children.

4a. In the presence of high inconsistent discipline there, will be a significant positive relationship between RSA reactivity and externalizing behaviors in children.

4b. In the presence of low parental involvement there, will be a significant positive relationship between RSA reactivity and externalizing behaviors in children.

4c. In the presence of poor parental monitoring, will be a significant positive relationship between RSA reactivity and externalizing behaviors in children.

Secondary Analyses

1. A moderating effect will be found between parenting practices, baseline SCL/RSA, and gender to predict child-externalizing behavior. However, given lack of research on these relationships, direction is not hypothesized.

2. A moderating effect will be found between parenting practices, baseline SCL/RSA, and yearly household income to predict child-externalizing behavior. However, given the lack of research on these relationships, direction is not hypothesized.

Assumptions of the Study

The assumptions for the study are as follows:

1. The participants provided honest and accurate responses to measures.
2. The children actively participated and followed the instructions given by the interviewer to the best of their ability while watching the video and during the performance task.
3. Research staff accurately and consistently followed administration procedures during the data collection process.
4. Data has been properly de-identified.
5. Data were accurately entered electronically into Excel following the data collection process.
6. Physiological data were properly collected and procedures concerning electrode placement were properly followed.

Limitations of the Study

The limitations for this study are as follows:

1. Only children ages 9-11 will be included in this study. Thus, the results may not be generalizable to a larger population.
2. The sample consists of at-risk children screened for moderate to severe aggressive behaviors. Thus, the results may not be generalizable to other populations.
3. The sample is from the southeastern part of the United States and may not be

generalizable to other geographical regions or populations.

4. Some child participants will be on varying types of medications.
5. The study will employ a teacher self-report and parent self-report method of data collection. Therefore, a caution must be employed, as there is a possibility of distortion or bias by the responder.
6. Electrodermal activity was recorded using the participant's nondominant hand because it leaves the dominant hand free to perform a task. Therefore, results will not be able to account for laterality differences in electrodermal activity.
7. Physiological data were collected in various locations. Thus, climatic conditions were not controlled.
8. This study used cross-section data, which limits directionality and causality.

Operational Definition of Terms

For the purposes of this study, the following terms are defined:

Externalizing behaviors: These particular behaviors refer to a constellation of behaviors characterized by aggressiveness, impulsivity and hyperactivity, noncompliance with adults, peer limit-setting, and delinquency (McMahon, 1994). For the current study, aggression, conduct problems, and hyperactivity encompass the externalizing behaviors construct. Further defined in Chapter 2.

Risk factors: These are aspects of the child and his or her environment that are associated with poor outcomes (Bergin & Bergin, 2012).

Environmental risk factors: These are factors associated with the child's system. Of specific interest to this current study are the parenting practices.

Child specific risk factors: These are factors specific to the child that do not change, or

that change in only one direction, and once present these factors always exist (e.g., gender, ethnicity).

Biological risk factors: These are factors that are inborn such as physiological systems. For the present study, skin conductance and respiratory sinus arrhythmia are of interest.

Social risk factors: These are factors associated with socioeconomic status, such as yearly family income and poverty.

Parent: This refers to the primary caretaker who participated in the interview process (e.g., birthparent, grandparent, adoptive parent, other relative).

Parenting practices: These are the most important aspects of parenting practices related to child behavior problems, as defined by Shelton, Frick, and Wootton (1996). The authors define the parenting practices as: parental involvement, poor monitoring and supervision, positive parenting, inconsistent discipline, and corporal punishment. For the current study, the parenting practices construct includes inconsistent discipline, poor monitoring and supervision, and parental involvement. This construct is further defined in Chapter 2.

Inconsistent discipline: This is the use of a variety of punishment strategies for similar incidents of child misbehavior or the termination of discipline due to lack of follow through or in response to coercive behavior by the child.

Poor monitoring and supervision: This is a lack of certain parenting behaviors involving attention to tracking the child's whereabouts and activities.

Parental involvement: This is the amount of participation of the parent in the child's life.

Autonomic arousal: This is a general state of physiological arousal mediated by the autonomic nervous system.

Social psychophysiology: This concerns the study of the cognitive, emotional, and

behavioral effects of human association as related to and revealed by physiological measures, interventions, consequences including the reciprocal relationship between physiological and social systems (Cacioppo, Tassinary, & Berntson, 2007).

Skin Conductance: This is an electrodermal activity measurement, further defined in Chapter 2.

Respiratory sinus arrhythmia: This is the waxing and waning of the heart rate across the respiratory cycle. This is further defined in Chapter 2.

Baseline: This is the heart rate measurement at the resting state. In the literature, baseline may also be referred to as tonic.

Reactivity: This is the deviation from the baseline measurement. In the literature, reactivity may also be referred to as phasic.

Organization of the Study

This dissertation is composed of five chapters. Chapter 1 briefly described externalizing behaviors in childhood, the purpose of the current study, as well as the assumptions, limitations, research questions, and definitions. Chapter 2 reviews the literature concerning externalizing behaviors in children. A review of the findings pertaining to biological and environmental risk factors of interest to this study is also included. Ultimately, a synthesis based on the literature is presented to corroborate the significance of the study. Chapter 3 outlines the research methods that were utilized to conduct this study. Specifically, Chapter 3 includes a description of the sample, procedures, instrumentation, and data analyses. Chapter 4 presents the results of the data analyses. Chapter 5 offers a discussion of the findings, limitations, and suggestions for future research.

CHAPTER II

REVIEW OF THE LITERATURE

Specific biological (i.e., autonomic arousal) and environmental (i.e., parenting practices) risk factors that have been found to predispose children to externalizing behavior problems are explored in this study (Deater-Deckard, Dodge, Bates, & Pettit, 1998). This chapter summarizes a review of three literatures (externalizing behaviors in childhood, autonomic arousal and its relation to externalizing behaviors, and the moderating role of parenting practices) related to this study. The review is organized into the following sections: (a) externalizing behaviors; (b) autonomic arousal and externalizing behaviors; (c) parenting and externalizing behaviors; and (d) parenting, externalizing behaviors, and autonomic arousal.

Externalizing Behaviors in Childhood

Externalizing behavior is a concept that encompasses several distinct types of behavior. In the literature, externalizing behavior problems have been extensively studied and defined. These particular behaviors refer to a constellation of behaviors characterized by aggressiveness, impulsivity and hyperactivity, noncompliance with adult and peer limit setting, and delinquency (McMahon, 1994). Frick, Lahey, Loeber, Tannenbaum, Van Horn, Christ, Hart, and Hanson (1993) performed a meta-analysis of 44 published factor analytic studies and empirically divided externalizing behavior into four clusters: aggression (e.g., fights, cruel), oppositionality (e.g., temper, defies), property violations (e.g., lies, vandalism), and status violations (e.g., substance use, breaks rules). The results of their meta-analysis were then cross-validated in a clinical sample of 177 boys aged 7 - 12 who were predominately Caucasian (70%). Externalizing

behaviors as defined by Frick et al. (1993), have been utilized by researchers such as: (1) Bongers, Koot, van der Ende, and Verhulst (2004) who studied the developmental trajectories of these particular behavior clusters; (2) Timmermans, van Lier, and Koot (2008) who studied the role of particular externalizing behaviors in late adolescent risky sexual behavior and substance use; and (3) Reef et al. (2011), who examined the prediction of adult psychopathology from developmental trajectories of the four clusters over a 24-year longitudinal study. These three studies distinguished that different clusters of externalizing behavior (e.g., aggression, status violations) lead to different outcomes. For example, Timmermans et al. (2008) found aggression in childhood and adolescence to be most consistently linked to later health risk outcomes and high levels of status violations to predict smoking and drug use in late adolescence. Further, Reef et al. (2011) found different subtypes of externalizing behaviors to be related to different adult outcomes. Additionally, status violations in childhood and adolescence were found to be most likely to be affected in adulthood.

Similar behavior clusters have been represented in the literature. For instance, researchers have utilized three behavior groupings to define externalizing behaviors (i.e., aggression, conduct problems, hyperactivity; Baker, Grant, & Morlock, 2008; Gladman & Landcaster, 2003; Hinshaw, 1987; Hinshaw, 1992). Additional terms used to describe externalizing behavior problems include "disruptive" and "antisocial" (Hinshaw, 1987; Liu, 2004). In the context of this study, three key behavior problems similarly make up the externalizing behaviors construct: aggression, conduct problems, and hyperactivity. Refer to the "Instrumentation" section in Chapter 3 for additional information regarding instrumentation selected to measure externalizing behavior constructs that were selected for use in the current study.

The externalizing behaviors of interest for this study were both symptoms and criteria for a number of psychiatric disorders that have a high level of comorbidity (APA, 2013). More specifically, these behaviors are evident in disorders such as attention-deficit hyperactivity disorder (ADHD) with a prevalence rate of 5% to 9%, oppositional defiant disorder ranging from 1% to 11%, with an average prevalence rate of 3.3%, and conduct disorder ranging from 2% to 10%, with an average prevalence rate of 4% (APA, 2013; Burt, Krueger, McGue, & Iacono, 2003). Prevalence rates of conduct disorder (CD) increase between childhood and adolescence, with childhood onset predicting greater subsequent aggression in children. CD is often preceded by a diagnosis of oppositional defiant disorder (ODD; APA, 2013). Externalizing problems are stable in both clinical and community samples, and clinical manifestations of these behaviors can be difficult to treat (see Erford et al., 2017 meta-analysis).

Hyperactivity

Hyperactivity refers to motor restlessness and overactivity when it is not appropriate, or excessive fidgeting, tapping, or talkativeness (APA, 2013). It is a behavior that is most commonly associated with ADHD, which is a disorder characterized by an ongoing pattern of inattention and/or hyperactivity-impulsivity that interferes with everyday functioning or development. ADHD symptoms begin in childhood as early as 3 to 6 years of age and must be present prior to the age of 12. The disorder is relatively stable through early adolescence but may worsen for some individuals with the development of antisocial behaviors. During the preschool years, the predominant manifestation of ADHD is hyperactivity (APA, 2013).

Aggression

Aggression can be expressed overtly (confrontation) or covertly (no confrontation) and have one of two functions (Dodge & Coie, 1987; Frick et al., 1993). In terms of underlying

function, there is strong empirical support categorizing aggressive behaviors into proactive and reactive aggression. Reactive aggression is emotionally driven, impulsive, defensive, and often referred to as "hot-blooded" aggression (Dodge & Coie, 1987). On the other hand, proactive aggression is "cold-blooded", unprovoked, deliberate, and purposefully goal-directed behavior (Dodge, 1991). Although children can manifest both forms of aggression, factor analytic work consistently finds proactive aggression and reactive to be independent dimensions (Raine et al., 2006; Fite, Colder, & Pelham, 2006).

Aggressive behaviors are common in the early years of childhood, but decrease over the course of early development as emotion regulation skills, problem-solving strategies, and language skills emerge (Bongers et al., 2004; Broidy et al., 2003; Tremblay, 2000). Children whose aggressive behaviors remain stable and above normal levels across development are at risk for adjustment difficulties and antisocial behavior in middle childhood, adolescence, and even young adulthood. Children with higher levels of stable aggression were found to have more severe adjustment problems (Broidy et al., 2003; Campbell, Spieker, Burchinal, Poe, & the NICHD Early Child Care Research Network, 2006). Campbell and colleagues (2006) found that even low stable aggression is a risk factor for some social problems.

Conduct Problems

Conduct problems refer to behaviors that exceed social and legal norms such as lying, stealing, cheating, destroying property, disobeying adults, talking back, fighting, hitting, and in more rare instances behaviors such as fire setting, vandalism, running away, and physical assault (APA, 2013). Like aggression, conduct problems tend to decrease after early childhood, but some children continue to exhibit conduct problems throughout their development (Campbell et

al., 2006). For a meta-analysis of counseling outcomes for the treatment of CD see Erford et al. (2017).

Theoretical/Conceptual Framework and Risk Factors for Externalizing Behaviors

The conceptualization of the models used in the current study owes much to Bronfenbrenner's Bioecological Systems Theory (Bronfenbrenner, 2001; Bronfenbrenner & Ceci, 1994). At the center, of the bioecological theory are four inter-related components which construct the process-person-context-time model (Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 2006). *Process*, the first component, accounts for the proximal and distal processes that involve a number of bidirectional transactions between the child and others and between them and their ecology. The *person* is endowed with genetic, physical, psychological, and behavioral characteristics that are all linked to development and can also influence proximal processes. *Context* incorporates the interacting systems and social characteristics surrounding the person, namely, the micro-, meso-, exo-, and macro- systems. Last, the *time* component accounts for chronological age, duration and degrees of impact of an event on development (Bronfenbrenner, 2001; Bronfenbrenner & Ceci, 1994).

The strengths of this framework include its rich description of the various environmental influences on child development that accounts for the contextual influences on child behavior. Though the bioecological model acknowledges the importance of the biological aspects of the child, the pathways and processes identified by Belsky (1997) further highlight the complexity of the understanding that child behaviors are the product of a combination of factors, not the least of which is the biological characteristics of the child, but which also include contextual factors like parenting practices (Gershoff, 2002). From the bioecological framework and the integration of Belsky's ideals, the current study will focus on specific risk factors found to be associated

with child externalizing behaviors.

In a large diverse community sample of 566 boys and girls aged 5 to 10 years, Deater-Deckard et al. (1998) found individual differences in externalizing behavior problems to be stable over time and to be related to individual risk factors (e.g., child, sociocultural, parenting, peer related). Risk factors are aspects of the child and his or her environment that are associated with poor outcomes (Bergin & Bergin, 2012). Though the risk factors of primary interest to this study are autonomic arousal and parenting practices, it is also important to consider how these interact with demographic characteristics of the child (e.g., gender, race, family income level).

Child specific risk factors. Specific to gender, in a longitudinal multiple birth cohort study of 2,076 children aged 4 to 18 years, Bongers et al. (2004) examined the age and group-based developmental trajectories of externalizing behaviors as defined by Frick et al. (1993). They found overall levels of externalizing behavior to be higher for males than females, though the shape of group-based trajectories were similar for males and females. Suggesting that despite differences in overall levels of externalizing behavior, the developmental pathways are the same for males and females. As for race, Deater-Deckard et al. (1998) found more psychosocial risk factors to be present for African American children compared to their European American peers. However, after controlling for SES, Detter-Deckard et al. found there were no racial group mean differences in aggression and externalizing scores. Thus, poverty, a sociocultural risk factor, accounted for the racial effects in Detter-Deckard et al.'s sample.

Sociocultural risk factors. Using Drillen's (1964) study exploring the growth and development of premature infants as an example, Bronfenbrenner (1999) illustrated that poverty is a significant risk factor influencing child behavior. In fact, poverty has been described as being among the greatest risk factors for childhood externalizing behavior problems (Linver et

al., 2002). In a sample of 493 Caucasian and African American low-birth-weight premature infants, family socioeconomic status was found to be a prominent risk factor for childhood externalizing behavior problems (Linver et al., 2002). Tremblay et al. (2004) also found poverty to be a significant predictor for antisocial behavior. The influence of socioeconomic status and family poverty on externalizing behavior problems in children is often linked through its impact on caregivers. For example, prolonged exposure to adverse events and stressors such as economic stress, crime, violence, unemployment, and insufficient resources, increased parents perceptions of stress and reports of depressive symptoms (Siefert, Finlayson, Williams, Delva, & Ismail, 2007).

Environmental risk factors. Linver and colleague's (2002) findings suggest that parenting and environmental factors have strong influences on the development and maintenance of child behavioral difficulties. More specifically, the literature supports that the development and maintenance of child behavioral difficulties has been associated with parenting challenges, including struggles with child management skills and discipline practices, challenges related to family communication, supervision and monitoring, and reduced positive parental involvement and warmth (Frick & Muñoz, 2006). DeMulder, Denham, Schmidt, and Mitchell (2000) found children from families with lower levels of stress were found to have more secure attachment relationships with their mothers. Those children who were found to be less securely attached to their mothers exhibited more aggressive behaviors in preschool (DeMulder et al., 2000). Further, the association between parenting practices and child behavior has also been described as bidirectional in that research suggests parenting practices affect child behavior and child behavior may also have an influence on parenting practices. Within this study, three parenting practices that have been associated with the development of externalizing behavior problems in

children were explored: (a) parental involvement, (b) poor monitoring and supervision, and (c) inconsistent discipline (discussed further in the "Parenting and Externalizing Behaviors" section**.**

Biological risk factors. There are considerable biological risk factors that have been examined in the literature to date (Efferson & Glenn, 2017; Winiarski, Hendrix, Smearman, & Brennan, 2017). Examples of such factors include traumatic experiences, maternal depression, maternal malnutrition, illness during pregnancy, smoking, alcohol or drug use during pregnancy, birth complications, and having a genetic predisposition to externalizing behavior. For instance, De Bellis et al. (1999) investigated cortisol regulation in 18 maltreated preadolescent children suffering from PTSD, with 24 age-matched controls. The PTSD maltreated children excreted significantly greater 24-hour urinary-free cortisol when compared to the non-maltreated control children. De Bellis and colleagues noted that male children were more vulnerable to the consequences of maltreatment and found this to be reflected in changes in brain structures. Specifically, the corpus callosum volume in males was especially decreased in the isthmus region of the corpus callosum, which was found to facilitate more externalizing behavioral symptoms of aggression and suicidality (De Bellis et al., 1999).

Maternal alcohol use during pregnancy can also affect biological risk factors. Alcohol has particular effects on the limbic system, including the hippocampus, which results in the decreased ability to transfer information and memories to long-term memory storehouses in the temporal lobes. Babies with fetal alcohol syndrome have smaller head circumferences at birth, thinner corpus callosum, and consistently lower IQ scores. Additionally, diminished executive functioning, short attention spans, difficulties in behavioral regulation, hyperactivity, impulsivity, clumsiness, poor balance, social deficits and poor judgment, were also found to be associated with fetal alcohol syndrome (Guerri et al., 2009; Sprang et al., 2009).

The biological risk factors central to the current study are measures of autonomic arousal, and they are, respiratory sinus arrhythmia (RSA) and skin conductance level (SCL). RSA and SCL are described in the next section. These physiological measures have been found to be significant predictors of externalizing behavior (Lorber, 2004).

In line with Bronfenbrenner's bioecological systems theory (Bronfenbrenner, 2001; Bronfenbrenner & Ceci, 1994), interactions between various child level and environmental level risk factors are influential to child development, and specific to the current study, the maintenance of externalizing behavior problems (for further review see Chapter 1). For example, Tung, Li, and Lee (2012) explored the moderating role of gender in a sample of 5 to 10-year old ethnically diverse boys and girls. They found inconsistent discipline and harsh punishment to be positively associated with aggressive childhood behaviors. Further, they found this relationship to be significantly moderated for boys but not for girls.

Interactions between sociocultural, biological, and environmental level risk factors have been found to put children at serious risk for externalizing behavior problems. Parents' poverty-related stress stemming from hardships associated with impoverished communities, such as lack of social support, housing and economic instability, community violence, and limited medical and mental health resources, may affect children's biology through chronic activation of biological stress mechanisms (Essex, Klein, Cho, & Kalin, 2002) or undermine parenting and the parent-child relationship (Acri, Chacko, Copalan, & McKay, 2017; Bronfenbrenner, 1999). To add, Dodge, Pettit, and Bates (1994), found family income to be significantly correlated with eight socialization variables (i.e., harshness of discipline, exposure to violence, peer stability, life stressors, mother's social support, mother's aggressive values, lack of maternal warmth,

cognitive stimulation) as well as predictive of teacher-rated externalizing behavior problems in children.

Autonomic Arousal and Externalizing Behaviors

As mentioned in a previous section, externalizing behaviors have been associated with differences in autonomic arousal. Autonomic arousal can be measured at rest, signifying baseline levels of arousal, or during a task or stressor, signifying autonomic reactivity. At this time, a broad understanding of psychophysiology and physiological systems is needed.

Psychophysiology can be defined as the scientific study of social, psychological, and behavioral phenomena as related to and revealed through physiological principles and events in functional organisms. Consequently, social psychophysiology concerns the study of the cognitive, emotional, and behavioral effects of human association as related to and revealed by physiological measures, interventions, and consequences including the reciprocal relationship between physiological and social systems (Cacioppo, Tassinary, & Berntson, 2007). Of specific interest to this current study, the autonomic nervous system (ANS) controls the basic visceral functions of the body including cardiovascular activity and metabolism (Bubier, Wampler, & Taylor, 2009). The autonomic nervous system is comprised of the sympathetic and parasympathetic branches. Each branch performs different bodily processes and, therefore, measurement of these two branches provides different physical, emotional, or behavioral information. The sympathetic nervous system (SNS) works to maintain homeostasis within the body, but also prepares the body for the fight or flight response, while the parasympathetic nervous system (PNS) conserves energy (Beauchaine, 2001).

Specific to the current study, skin conductance level (SCL) and respiratory sinus arrhythmia (RSA) are two variables that have been found to influence behavior in adults and

children (Lorber, 2004). For example, low baseline SCL (Gatzke-Kopp, Raine, Loeber, Stouthamer-Loeber, & Steinhauer, 2002; Lorber, 2004) and low baseline RSA (Beauchaine, 2012) have been associated with symptoms of externalizing psychopathology. The following discussion summarizes the findings of research on RSA and SCL as they are related to child externalizing behaviors.

Respiratory Sinus Arrhythmia and Externalizing Behaviors

It is beyond the scope of this chapter to give a comprehensive account of the cardiovascular system. For a more detailed understanding of these systems see Berntson, Quigley, and Lozano (2007). As an overview, the cardiovascular system is under the control of both the sympathetic and parasympathetic branches of the ANS (Berntson et al., 2007). Heart rate has been evidenced in the literature as being a predictor of externalizing behaviors (Essau, Sasagawa, & Frick, 2006; Moffitt & Caspi, 2001). Though research on the relationship between HR and externalizing behaviors in children has yielded consistent findings, one of the limitations of HR is that it is influenced by both the sympathetic and parasympathetic branches of the ANS (Beauchaine, 2009). Since an independent measure of SNS activity (i.e., SCL) will be utilized in the current study, an independent measure of parasympathetic activity, vagal tone (RSA) will be employed in this planned study.

Vagal tone and vagal tone reactivity are two indices of PNS functioning and are markers of psychological functioning. Vagal tone is considered to reflect the level of activity in the parasympathetic nervous system. During inhalation, the inhibitory influence of the PNS, via the vagus nerve, decreases and there is a corresponding increase in heart rate (Berntson et al., 2007). This is due to the heart period being shorter which consequently causes an increase in heart rate during inhalation. RSA is this oscillatory interaction between the heart and respiratory system.

Conversely, during exhalation, vagal inhibition resumes and heart rate decreases. Additionally, greater PNS activity results in decreased heart rate, which in turn results in increases in RSA (Berntson et al., 2007). The myelinated vagus nerve, or tenth cranial nerve, on the heart functions as an active vagal brake in which rapid inhibition and disinhibition of vagal tone to the heart can rapidly mobilize or calm an individual (Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996). When a threat or stressor in the environment is perceived, the vagal brake is released which serves to increase sympathetic arousal and initiate a "fight or flight" response (Hastings et al., 2008). This vagal brake allows an individual to rapidly engage and disengage with objects and other individuals, which in turn allows for the promotion of self-soothing behaviors and calm behavioral states (Porges, 2001). An increase in sympathetic arousal is adaptive when a true threat in the environment is present. It allows for adequate coping responses to real or perceived threats. Whereas, decreased vagal tone in a non-threatening environment is maladaptive. In this case, individuals are prepared to engage defense mechanisms in response to perceived but unfounded threats.

In research, vagal tone is typically estimated from respiratory sinus arrhythmia (RSA), the ebbing and flowing of heart rate during spontaneous respiration (Bubier & Drabick, 2008; Grossman & Taylor, 2007; Katona & Jih, 1975). RSA is an index of PNS functioning that has emerged as a valid and reliable peripheral marker of self-regulation (Beauchaine, 2015). Porges's (1995) polyvagal theory introduces a model to explain the relation between vagal tone during baseline and vagal reactivity in response to environmental stressors. According to this theory, baseline measures of vagal tone represent an individual's ability to maintain homeostasis and the potential responsiveness of that individual. In short, it is an indicator of parasympathetic activity. As evidenced by Beauchaine (2001), high levels of baseline vagal tone have been

associated with an individual's capacity to maintain a positive physiological state. Baseline RSA is an index of the PNS at rest while vagal reactivity refers to increases or decreased in cardiac output by vagal pathways to facilitate physiological regulation and responding to environmental stressors (see Porges, 2007). When RSA is measured during a quiet resting state (baseline), higher scores are thought to indicate physiological flexibility, the ability to adapt to environmental stressors and conservation of resources (Fabes & Eisenberg, 1997). Therefore, higher baseline RSA is generally considered adaptive, and is associated with better emotion regulation abilities (Beauchaine, 2001; Porges, 2007), though excessive RSA has been linked with social maladjustment and anxiety (Beauchaine, 2015). As for RSA reactivity, it is the deviation from baseline RSA when individuals are exposed to stressors, engaged in a cognitively demanding task, or when their emotional states change (Gramzow, Willard, & Mendes, 2008).

Baseline RSA has been found to be inversely related to externalizing behaviors, as reduced vagal tone is associated with externalizing disorders such as antisocial behavior and aggression. Emergent evidence has shown that baseline RSA may be reduced rather than elevated in behaviorally disordered children and adolescents. More specifically, low baseline RSA has been associated with poor emotion regulation, such as aggressiveness in youth (Beauchaine, Gatze-Kopp, & Mead, 2007). High baseline RSA reflects adequate emotional reactivity, and serves as a protective factor and trait index of the potential to cope with negative environmental stressors (Beauchaine, 2001; Calkins, Graziano, & Keane, 2007; Vasilev, Crowell, Beauchaine, Mead, & Gatzke-Kopp, 2009). Lower RSA reactivity is thought of as a state-like physiological response to a stressor that promotes self-regulation and coping, whereas, higher RSA reactivity has been associated with greater problem behavior (Beauchaine et al., 2007; Vasilev et al., 2009). These findings are consistent with those from a study by Jimenez-

Camargo, Lochman, and Sellbom (2017). Using a similar data set as the current study, Jimenez-Camargo et al. (2017) examined the impact of autonomic regulation, affective experience, and effortful control on externalizing behavior in an at-risk sample of preadolescents, and found higher parasympathetic reactivity (RSA reactivity) to predict greater externalizing behavior. Furthermore, in their longitudinal study with a community sample, Hinnant and El-Sheikh (2009) found children with both lower baseline RSA and lower RSA suppression (decline in RSA from baseline to task) to have an increased risk of developing later externalizing problems.

Gender differences and RSA. Bubier, Drabick, and Breiner (2009) examined the association of autonomic functioning in the relationship between contextual factors and externalizing behaviors in 57 predominately African American children of which half were male. They did not find sympathetic reactivity to influence the relationship between contextual factors and externalizing behaviors, and they explained this may have been due to gender. Due to limited power, Bubier et al. did not test separate models for males versus females, but generally found males to exhibit a greater change in sympathetic functioning from baseline to task, as compared to females. In their study examining sex differences in autonomic functioning in children with conduct problems, Beauchaine, Hong, and Marsh (2008) found that highly aggressive males had lower baseline RSA while females exhibited no difference in baseline RSA, regardless of the child's level of aggression. The authors' findings concluded that the pattern of physiological responses among females did not resemble the pattern among males (Beauchaine et al., 2008). In an earlier study, Eisenberg, Fabes, Murphy, Maszk, Smith, and Karbon (1995) found males aged 6 to 8 years with high baseline RSA to be more sociable and emotionally regulated than males with baseline low RSA, as rated by their teachers and parents.

Skin Conductance Level and Externalizing Behaviors

It is far beyond the scope of this chapter to give an exhaustive description of the skin's complex features, therefore, anatomical aspects of this organ will not be discussed. For a more detailed understanding of these systems see Boucsein (2011). However, this section will outline the physiological mechanisms required for an understanding of electrodermal activity (i.e., SCL).

The skin is a selective barrier that serves the function of preventing entry of foreign matter into the body. It protects the body from environmental threats such as temperature, chemicals, and infectious agents and selectively facilitates passage of materials from the bloodstream to the exterior of the body. This organ aids in the maintenance of water balance and of constant core body temperature through variations in the production of sweat (Bouscein, 2011). There are two types of sweat glands (i.e., apocrine, eccrine) in the body. Eccrine sweat glands are most relevant to the current study. Though the primary function of eccrine sweat glands is thermoregulation, due to the high gland density, eccrine sweat glands located on the palmar and plantar surfaces have been suggested to be more responsive to psychologically significant stimuli than to thermal stimuli.

In terms of electrodermal activity, a small current is passed through a pair of electrodes placed on the volar surface of the skin. As sweat fills the sweat gland ducts, a more conductive path is formed (Dawson, Schell, & Filion, 2007). SCL, a measurement of electrodermal activity, measured during baseline conditions is considered a marker of the activity of the SNS, and has been associated with many symptoms of developmental psychopathology. SCL reactivity reflects activation of the sympathetic nervous system in the context of stress. In response to perceived stress, SNS activation mobilizes resources needed to behaviorally respond to the environment by increasing heart rate, oxygen flow, and perspiration. This process is

demonstrated in the "fight-or-flight" response (Boucsein, 2011). Adaptive responding during stressful situations would result in a moderate increase of SNS activation (Beauchaine, 2001; Porges, 2007). However, lower or higher SNS reactivity may indicate a dysregulated stress response (Beauchaine, 2001; Fowles, Kochanska, & Murray, 2000). Higher SCL reactivity (SNS activation) is thought to facilitate voluntary behavioral inhibition through the production of fear and anxiety (Beauchaine, 2001), while exaggerated SNS reactivity may elicit high emotional arousal which in turn results in externalizing behaviors (e.g., aggression; Scarpa & Raine, 1997). Gatzke-Kopp et al. (2002) performed a study involving 335 boys split between a control group and those with serious delinquency problems. They found delinquency and sensation seeking were characterized by low baseline SCL. In addition to their parasympathetic findings, Jimenez-Camargo et al. (2017) found lower sympathetic reactivity (SCL reactivity) to predict greater externalizing behavior in a sample of at-risk preadolescents.

Gender differences and SCL. Findings in the literature demonstrate that individual differences in ANS functioning influence children's susceptibility to risk factors. For instance, El-Sheikh, Keller, and Erath (2007) found stronger associations between parents' marital conflict and children's internalizing and externalizing problems among girls with heightened SCL reactivity, but among boys lower SCL reactivity predicted stronger associations between parental conflict and externalizing problems. Further, in a longitudinal study examining 56 male and 54 female adolescents, Diamond, Fagundes, and Cribbet (2012) found heightened SCL reactivity was associated with elevated daily negative affect among girls with high-internalizing mothers, but lower daily negative affect among girls with low-internalizing mothers. Consistent with El-Sheikh and colleagues (2007), Diamond et al. (2012) found lower (rather than higher) SCL

reactivity predicted higher risk of externalizing behavior problems for girls in single-parent homes.

Inconsistencies in the Literature and the Current Study

There are conflicting results from empirical research on the relationships between autonomic arousal and externalizing behaviors for which the current study aims to provide more clarity. In regard to conflicting findings specific to RSA, Beauchaine et al. (2007) found reduced baseline RSA in samples of aggressive youth, while Calkins et al. (2007) found no significant relationship between baseline RSA and externalizing behaviors. In terms of RSA reactivity, conflicting results are similarly found. For example, in a population cohort of 10 to 13 year-old children, Dietrich et al. (2007) found there was no relationship between RSA reactivity and externalizing symptoms, while in a study of 335 five-year-old children, Calkins et al. (2007) found those with externalizing symptoms exhibited lower levels of RSA reactivity.

Though findings on baseline SCL have been consistent, research looking at SCL reactivity has produced mixed findings. For example, children with high SCL reactivity and high parent depressive symptoms were most at risk for developing internalizing, externalizing, and social problems (Cummings, El-Sheikh, Kouros, & Keller, 2007). While harsh parenting predicted higher externalizing problems among boys with low SCL reactivity (Erath et al., 2009). Suggesting that the impact of parenting practices can depend on the physiological aspects of the child (e.g., SCL reactivity), but the nature of the relationship may depend on the specific predictors and outcomes being examined.

Parenting and Externalizing Behaviors

It is also evidenced in the literature that conflict between parents and children increases the risk for childhood externalizing disorders. For instance, parental factors have been identified

as one of the primary factors in the development and maintenance of externalizing behavior problems in children (Frick, 1994; Loeber & Stouthamer-Loeber, 1986; Stormshak, DeVargas, & Cardenas, 2017). Further, harsh and inconsistent parenting, poor parental monitoring, and corporal punishment have been associated with externalizing behavior problems in young children while positive parenting behaviors may act as a protective factor (Colder, Lochman, & Wells, 1997; Lorber, O'Leary, & Smith Slep, 2011). For children, the quality of parenting is one of the most influential components of their social environment (Bronfenbrenner & Ceci, 1994). Research denotes parenting practices as a key dimension in the development and prevention of externalizing symptoms (Essau et al., 2006; Scott, Briskman, & Dadds, 2011). In this section, three parenting practices that have been associated with the development of externalizing behavior problems in children will be discussed: (a) inconsistent discipline, (b) poor monitoring and supervision, and (c) parental involvement.

Inconsistent Discipline

Inconsistent discipline is described as the use of a variety of punishment strategies for similar incidents of child misbehavior, or as the termination of discipline due to lack of follow through. Inconsistent discipline also can be evident when rules that are either unclear or are not enforced by the parent. Research has found that inconsistent discipline is a significant risk factor for the development of externalizing behaviors in children (Stormshak, Bierman, McMahon, & Lengua, 2000). For instance, Bor, Sanders, and Markie-Dadds (2002) found a lack of rules in combination with negative parenting practices, to be a contributing factor to negative child behavior. In a study of 1,056 mothers with young children, it was found that mothers who were unmarried, poorer, younger, and less educated reported more behavior problems, though parental discipline was the strongest predictor of behavior problems (Brenner & Fox, 2001). Loeber and

Stouthamer-Loeber (1986) also found mothers of children with CD to be poor at supervising their child's behavior and inconsistent with discipline practices.

Poor Monitoring and Supervision

Parental monitoring is a strategy by which parents stay informed of their child's behavior, friendships, and activities by tracking the child's whereabouts and attending to the child's conduct (Dishion & McMahon, 1998). Parental monitoring has been shown to be a consistent predictor of positive child development and a protective factor for problem behavior (Crouter & Head, 2002). During childhood, parental monitoring primarily takes place in the home and school settings, whereas in adolescence, parents must adapt monitoring strategies to include tracking activities with peers and unsupervised activities in the community (Racz & McMahon, 2011). In their meta-analysis, Loeber and Stouthamer-Loeber (1986) found supervision and parental monitoring to be strongly linked to disruptive child behavior. Specifically, they found poor supervision to be one of the strongest variables related to behavior problems in 10 of the 11 studies reviewed on parental monitoring. Frick, Christian, and Wootton (1999) found poor supervision to be predictive of conduct problems and Colder et al. (1997) highlighted the importance of accounting for individual differences as they found poorly monitored active boys and fearful boys who were harshly disciplined to exhibit high levels of aggression.

Parental Involvement

In their meta-analysis, Loeber and Stouthamer-Loeber (1986) found a relation between lack of parental involvement and externalizing behaviors in children. Parental involvement refers to the parent's amount of participation in the child's life. Loeber and Stouthamer-Loeber (1986) pinpointed specific indices of lack of parental involvement, which ranged from the absence of outings with parents to neglect, indifference, ignoring, and less cooperation. In a

more recent study, Li, Clark, Klump, and Burt (2017) examined parental involvement and found poor maternal involvement to affect the development of ODD.

Parenting and the Current Study

As evidenced in the literature, environmental factors such as parenting have profound effects on child behavior. Poor parenting practices have been identified as predictors of the development and maintenance of externalizing behaviors in children. Examining specific parenting practices (i.e., parental involvement, poor monitoring and supervision, inconsistent discipline), may help increase knowledge of the mechanisms by which parenting practices influence child behavior. In turn, this can further inform and facilitate the creation of various parenting or family-level interventions to both prevent and address externalizing behavior problems. Although the efficacy of behavioral parent training programs for externalizing behaviors has been well established in the literature (see McMahon, Wells, & Kotler, 2006), the role of innate biological processes in children most "at-risk" for sustained externalizing behaviors over time has not been researched as closely.

Parenting, Autonomic Arousal, and Externalizing Behaviors

There is substantial literature addressing parenting practices, externalizing behaviors in children, and autonomic arousal. Within this branch of literature, the results have been mixed and they have focused on various parental factors (e.g., harsh parenting, corporal punishment) and behaviors (e.g., aggression) in children. At best, current knowledge has explored the relationship between any two of these three variables, but few studies have explored the intersection of all three. For instance, one study by Erath et al. (2009) examined the influence of harsh parenting in the association between SCL reactivity and externalizing behaviors in a community sample of 251 children. It was found that for children who exhibited lower SCL

reactivity the influence of harsh parenting on externalizing behavior was strong, but for those exhibited higher SCL reactivity, the influence of harsh parenting on externalizing behavior, though significant, was attenuated (Erath et al., 2009). Other studies have found that low SCL reactivity paired with harsh parenting creates the highest risk for externalizing problems (Erath et al. 2011; Kochanska et al., 2015). Bubier et al. (2009) also examined the influence of contextual factors (i.e., neighborhood cohesion, harsh parental behaviors) on the relationship between autonomic functioning and externalizing behaviors in a sample of inner-city fourth grade children and their primary caregivers. They found harsh parenting to be associated with lower levels of externalizing behaviors among children with attenuated baseline SNS functioning and higher levels of externalizing behaviors among children with heightened baseline SNS functioning (Bubier et al., 2009).

The literature suggests that physiological processes within the child are processes that years of development have fine-tuned and are associated with externalizing behavior problems. It is further suggested that environmental factors (i.e., parenting practices) are primary factors in the development and maintenance of externalizing behavior problems in children and the impact of parenting behavior on child behavior may depend on PNS and SNS functioning. A review of the literature reveals mixed findings and a need to further examine both branches of ANS functioning. Among other things, Erath et al. (2009) identified the need for future research to consider child behaviors within the school setting and to look at a sample of children with a higher disposition for externalizing problems.

The current study will expand on the literature by examining the effect of parenting practices (i.e., parental involvement, poor monitoring and supervision, inconsistent discipline) on the relationship between autonomic arousal (i.e., baseline SCL, baseline RSA, SCL reactivity,

RSA reactivity) and both parent and teacher reported externalizing behaviors (i.e., aggression, conduct problems, and hyperactivity) in an at risk sample of children screened for moderate to high levels of aggression. This study will further contribute to the literature on parenting variables, which has almost exclusively focused on marital conflict (El-Sheikh et al., 2007), harsh parenting (Erath et al., 2009), and parent psychopathology (Abaied, 2016; Cummings et al., 2007).

Summary

The purpose of this study was to examine inconsistent discipline, parental involvement, and poor monitoring and supervision as moderators in the relationship between autonomic arousal and externalizing behaviors in an at risk sample of children. To fully grasp the concept and the development of the conceptual and statistical models for use in the current study, it was necessary to provide background information on each variable of interest. The following chapter discusses the research methods that were utilized to conduct this study (i.e., description of participants, procedures, instrumentation, data analyses).

CHAPTER III

METHODS

The current study aimed to examine the moderating role of parenting on the relationship between externalizing behaviors in children and autonomic arousal. This chapter presents information related to participants, study procedures, instrumentation used, and plans for data analysis that was used to test the hypotheses relevant to the current study. The purpose of this study was to fill an existing gap in the literature.

Research Question

The following research questions were addressed:

1. Does parenting practice affect the relationship between baseline SCL and externalizing behaviors in children?
2. Does parenting practice affect the relationship between baseline RSA and externalizing behaviors in children?
3. Does parenting practice affect the relationship between SCL reactivity and externalizing behaviors in children?
4. Does parenting practice affect the relationship between RSA reactivity and externalizing behaviors in children?

Hypotheses

The following hypotheses were tested:

1a. In the presence of high inconsistent discipline there, will be a significant negative relationship between baseline SCL and externalizing behaviors in children.

1b. In the presence of low parental involvement there, will be a significant negative relationship between baseline SCL and externalizing behaviors in children.

1c. In the presence of poor parental monitoring, there will be a significant negative relationship between baseline SCL and externalizing behaviors in children.

2a. In the presence of high inconsistent discipline there, will be a significant negative relationship between baseline RSA and externalizing behaviors in children.

2b. In the presence of low parental involvement there, will be a significant negative relationship between baseline RSA and externalizing behaviors in children.

2c. In the presence of poor parental monitoring, there will be a significant negative relationship between baseline RSA and externalizing behaviors in children.

3a. In the presence of high inconsistent discipline there, will be a significant positive relationship between SCL reactivity and externalizing behaviors in children.

3b. In the presence of low parental involvement there, will be a significant positive relationship between SCL reactivity and externalizing behaviors in children.

3c. In the presence of poor parental monitoring, there will be a significant positive relationship between SCL reactivity and externalizing behaviors in children.

4a. In the presence of high inconsistent discipline there, will be a significant positive relationship between RSA reactivity and externalizing behaviors in children.

4b. In the presence of low parental involvement there, will be a significant positive relationship between RSA reactivity and externalizing behaviors in children.

4c. In the presence of poor parental monitoring, will be a significant positive relationship between RSA reactivity and externalizing behaviors in children.

Secondary Analyses

1. A moderating effect will be found between parenting practices, baseline SC/RSA, and gender to predict child-externalizing behavior. However, given lack of research on these relationships, direction is not hypothesized.
2. A moderating effect will be found between parenting practices, baseline SC/RSA, and yearly household income to predict child-externalizing behavior. However, given the lack of research on these relationships, direction is not hypothesized.

Participants

This study includes a sample of 360 child-parent pairs and their public school teachers. Participants in this study were recruited over a three-year period from 20 different elementary schools in both urban and suburban areas in the southeastern part of the United States. The recruitment process involved screening methods completed by both teachers and parents for eligibility.

In the first step of the screening process, 4th grade teachers reported on the frequency in which students demonstrated specific aggressive tendencies by completing the Reactive and Proactive Aggression Questionnaire (RPQ; Dodge & Coie, 1987) on each student in their classroom. For the RPQ, scores range from 6 to 30. Teachers provided ratings for up to 30 students per year. Ratings were compiled across all 20 schools, and a cut-off score corresponding to the top 25th percentile was determined, indicating moderate to high levels of aggressive behavior. The cut-off score used for this study was a score of 13. Of the 4,598 children screened, 1,183 scored at or above the cut-off score. The children who scored at or above the cut-off score were considered eligible for the parent screening.

For each school, a randomized list of eligible students was created, and families were contacted according to their placement on the list. Though schools varied in the number of students who fell within the eligible range, six children were recruited from each of the 20 schools. In instances when there were not enough students who fell within the eligible range, on a school-by-school basis, the cut-off score was lowered in order to recruit 6 children. The Behavior Assessment System for Children, (BASC; Reynolds & Kamphaus, 1992) Aggression scale was included in the parent assessment battery as a second screen. Children whose parents rated them within the average range or above on this scale were invited to enroll in the study. Families were contacted and assessed according to these procedures until six children were enrolled at each of the 20 schools. Of the 497 families that were contacted, 39 did not pass the parent screen, 47 declined to participate or did not schedule an appointment, 30 did not show up for the scheduled interview appointment, 17 moved to a non-participating school, 3 were ineligible because of a prior sibling enrollment, and 1 was dropped because of a scoring error.

The recruitment process was completed for each of the three annual cohorts, resulting in a total sample size of 360 parent-child pairs. In the current study, the term parent refers to the primary caretaker who participated in the interview process. For instance, 87.8% (n = 316) of interviews were completed by the child's birthparent while the remaining were completed by step-parents, adoptive or foster parents, and other relatives (i.e., aunts, grandparents). Of the 360 parents who participated in the interview process, 95% (n = 342) were female.

In terms of demographic data of the sample, 65% (n = 234) of the recruited children were male and 35% (n = 126) were female. The children's ages ranged from 9 to 11 (M = 10.22, SD = .51). The parent-reported racial/ethnic composition of the children was 76.1% African American (n = 274), 19.7% Caucasian (n = 71), 3.1% More than one race (n = 11), and 1.1%

Hispanic (n = 4). Regarding yearly family income, 61.9% of parents reported a household income less than $30,000 (refer to Table 1 for demographic breakdown).

Table 1

Characteristics of the Sample (N = 360)

	Frequency	Percent
Gender		
Male	234	65
Female	126	35
Race		
Hispanic	4	1.1
African American	274	76.1
Caucasian	71	19.7
More than one race	11	3.1
Family Income per Year (in dollars)[a]		
Earns less than $30,000	223	61.9
Earns more than $30,000	137	38.1
Caregiver Gender		
Male	18	5
Female	342	95
Caregiver Assessed		
Birthparent	316	87.8
Stepparent	3	.8
Adoptive parent	3	.8
Other relative	6	1.7
Foster parent	4	1.1
Grandparent	23	6.4
Other	5	1.4

[a] Income ranges were as follows: Earns less than $10,000, $10,000-$14,999, $15,000-$19,999, $20,000-$24,999, $25,000-$29,999, $30,000-$34,999, $35,000-$39,999, $40,000-$49,999, $50,000-$59,999, $60.000-$74,999, $75,000-$99,999, Earns $100,000 or more.

In order to determine the sample size for a moderation analyses, a power analysis was conducted using G*Power (Faul, Erdfelder, Buchner, & Lang, 2009). Following Cohen's (1988) conventions, a moderate effect size of .15, error probability of .05, and power of .8 for three predictors (X, M, X× M) was utilized to estimate statistical power for primary analyses. A recommended sample size of 77 participants was found for A priori G*Power analysis (Faul, Erdfelder, Buchner, & Lang, 2009). The observed sample size of 360 participants met this

criterion and was therefore sufficient for the current study. A sample size greater than the recommended value also increased the power of the statistical analysis being conducted. A Post Hoc G*Power analysis determined that the current sample size would yield a power of .99.

Procedures

Participants included in the analyses for this study were drawn from a randomized controlled trial examining the relative effectiveness of individual and group formats of the Coping Power program (Lochman et al., 2008). Three cohorts of 120 children were recruited over three subsequent years. As part of the recruitment phase, parents were informed of the larger project (i.e., the randomized controlled trial) by a notification form describing the screening process. Parents who did not want to participate were instructed to return the form to their child's school indicating this preference.

As described in the "Participants" section, during the recruitment phase, 4th grade teachers completed the RPQ (Dodge & Coie, 1987) on each child in their classroom. During the pre-intervention phase (Time 1), measures were completed with all enrolled children and parents, as well as with their corresponding teachers during the spring semester of the students' 4th grade year. Children and parents were interviewed separately in the child's home, unless other locations were requested by the parent (e.g., research office, public library). Teacher measures were self-administered. Data were also collected mid-intervention (Time 2) and post-intervention (Time 3). To avoid any potential intervention effects, only time 1 data was utilized for the current study.

Instrumentation

Demographic Measure

Demographic information was collected from the parent's portion of the interview process. The demographic data that will be utilized in this study include gender, age, and race/ethnicity (i.e., Caucasian, African American, Hispanic or Latino, Asian, American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, and more than one race) of the child, as well as yearly family income in dollars (i.e., earns less than $10,000, $10,000-$14,999, $15,000-$19,999, $20,000-$24,999, $25,000-$29,999, $30,000-$34,999, $35,000-$39,999, $40,000-$49,999, $50,000-$59,999, $60.000-$74,999, $75,000-$99,999, $100,000 or more). For this study, yearly income level has been dichotomized at the $30,000 threshold to be representative of the federal poverty level for a household of 5 to 6 persons (Department of Health and Human Services, 2017).

Reactive and Proactive Aggression Questionnaire

To identify students with moderate to high levels of aggression, 4th Grade teachers completed the 6-item RPQ (Dodge & Coie, 1987) for all of the children in their class. This instrument consists of three items assessing reactive aggression ("overreact angrily to accidents," "when teased strikes back," and "blames others in fights") and three items assessing proactive aggression ("gets others to gang up on a peer," "uses physical force to dominate," and "threatens and bullies others"). Items were rated on a 5-point scale (e.g. 1 = Never to 5 = Almost Always). A combined reactive and proactive aggressive behavior score was obtained by summing the items on each of these scales (total scores range from 6 to 30) (Dodge & Coie, 1987).

Physiological Measures

A BioLog™ (UFI, Morro Bay, CA) physiological data recorder was administered to measure the participant's heart rate, interbeat interval (IBI), and skin conductance level (SCL). To obtain these specific measures, the BioLog™ recorder was attached through the use of bioelectric and transducer input assemblies. The BioLog™ has a microprocessor system that allows for the data to be simultaneously recorded and stored.

As stated in the procedures section, interviews were conducted in various locations (e.g., participant's home, research office, public library). Due to the variability of location conditions and lack of a controlled environment, interviewers were instructed to record the temperature (M = 74.1, SD = 4.1) and humidity (M = 46.6, SD = 8.3) level at the time of the physiological assessment. Temperature and humidity are two environmental factors that influence electrodermal activity through hydration of the stratum corneum (outermost layer of the epidermis; Cacioppo et al., 2007). Boucsein (2011) suggested a room temperature of 73.4 °F. However, a range of room temperatures has been represented in the literature. For example, Venables and Christie (1973) utilized a laboratory temperature range between 68°F and 86°F.

Further, to evaluate the influence of medications or drugs on the child's psychophysiological measurements, each child was asked whether he/she had used alcohol, marijuana, or other substances in the past 24 hours. Child self-reported drug use included .6% who identified they had used drugs or alcohol in the specified timeframe. Additionally, parent-reported medication use indicated 19.8% of child participants were receiving medication at the time of assessment to control behavior and/or attention (e.g., Ritalin/Dexedrine, anti-depressants, Vyvanse, Risperdal, Concerta, Focalin). After further statistical inquiry, medication use was not correlated to SCL, $r(248) = -.040$, p = n.s. or RSA, $r(270) = -.081$, p = n.s.

During the psychophysiological assessment, electrodes were attached to the child's finders, neck, collarbone, and knee. Following the placement of electrodes, each participant viewed a video 128 seconds in length depicting Hawaiian scenery. This video was meant to be a neutral stimulus that was unlikely to elicit an emotional response within the child participant. The purpose of this procedure was to allow the participant time to become acclimated to the physiological assessment equipment. This procedure aimed to reduce the potential of the participant's unfamiliarity with the equipment from becoming a confounding factor. Baseline RSA and SCL were calculated using physiological data collected during the final 60 seconds of the video.

After the video, participants were instructed to play the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994), a 25-minute computerized decision-making task specifically designed to invoke stress. The task consisted of 5 blocks of 20 cards for a total of 100 cards. Prior to playing the computerized task, instructions were read to the participants. At that time, participants were made aware that they would gain or lose money each time they selected a card from one of the four available decks (decks A, B, C, & D). They were provided a starting balance of $2,000 in virtual play money and were told the goal of the task was to earn as much money as possible. After each card draw, money was earned. After some cards were drawn, participants were both given money and asked to pay a penalty. Turning cards from decks A or deck B yielded a win of $100; turning from deck C or deck D yielded a win of $50. Though decks A and B yielded a higher gain, they cost the most in the long run due to high penalties. Penalties were determined by a preprogrammed schedule that is unknown to the participant. See Bechara et al. (1994) for details about the schedule of payouts and penalties related to specific card draws.

In order to identify artifacts in the data prior to analysis, the interviewer charted interbeat interval and skin conductance values every 5 minutes during the administration of the IGT (Bechara et al., 1994) and collection of physiological data. Block and reactivity scores for SCL and RSA were measured for the duration of the 25-minute task. Subtracting block values of RSA/SCL from baseline values will create reactivity scores for each block. During the first two blocks, the participants were largely getting accustomed to the frustrating task, so the first two block reactivity scores will be used in analyses given that they are likely more representative of reactivity.

RSA data acquisition and reduction. To determine RSA, both heart rate and IBI were measured through the use of three electrodes; one placed above the participant's right collar bone, another behind the participant's left knee, and a reference electrode placed on the right side of the participant's neck. Of the 360 children enrolled in the study, 94.4% (n = 340) completed the baseline (Time 1) physiological measurements. Of these, 59 participants had IBI data that were unusable due to noise in the data or errors in recording. The final sample of IBI data included 281 participants. At the time of recruitment, the 281 children with IBI data ranged in age from 9 to 11 years (M = 10.23, SD = .51). This particular data set included 183 males and of the 281 participants, 77.2% identified as African American.

Designed for use alongside the CardioEdit (CardioEdit, 2007) and CardioBath (CardioBatch, 2007) computer programs, RSA was derived from techniques in the manual Inter-Beat-Interval Editing for Heart Period Variability Analysis: An Integrated Training Program with Standards for Student Reliability Assessment (Porges, 2007b). These computer programs were used to quantify and evaluate heart rate patterns.

To ensure quality data for statistical analysis, the first procedure was to edit and reduce artifacts in each IBI file that was collected using the Biolog. As per procedures outlined in the manual, each participant's heart rate data were hand-edited using the CardioEdit program in order to remove any unwanted artifacts. Artifacts are errors in the IBI data that are likely due to the digitizing process of the data or to child movement during the recording process. Each IBI file was scanned for outlier data points relative to adjacent data points. These outlier points were replaced by data that was more consistent with the surrounding data. After data cleaning, RSA was extracted from one of the predominant rhythms exhibited in the data via computations of the participant's heart period series using the CardioBatch program.

SCL data acquisition. SCL and SCL reactivity were measured by attaching electrodes to the volar surface of the distal phalanges of the first and third fingers of the participant's non-dominant hand using Velcro bands (Scerbo, Freedman, Raine, Dawson, & Venables, 1992). More specifically, reusable Ag-AgCl electrode disks in a holder made of delrin with a generously contoured front face were used. Prior to use, Biogel was added to the cavity above each electrode disk. Biogel is a general-purpose biopotential contact medium used between the participant's skin and the electrode surface. The participant's nondominant hand was used because it leaves the dominant hand free to perform the decision-making task.

As noted previously, of the 360 children enrolled in the study, 94.4% (n = 340) completed the baseline (Time 1) physiological measurements. Of these, 58 participants had SCL data that were unusable due to noise in the data or errors in recording. The final sample of SCL data included 302 participants. At the time of recruitment, the 302 children with SCL data ranged in age from 9 to 11 years (M = 10.24, SD = .52). This particular sample included 197 males and of the 302 children, 77.8% identified as African American.

SCL data was processed and artifact removal was completed through the use of Ledalab (Benedek & Kaernbach, 2010), a Matlab-based software for the analysis of SCL data. Each SCL file was scanned for outlier data points relative to adjacent data points. These outlier points were replaced by data that were more consistent with the surrounding data. After data cleaning, data were exported to Excel and SPSS, respectively.

Behavior Assessment System for Children

Externalizing behaviors in children were assessed using the Parent Rating Scale (PRS) and Teacher Rating Scale (TRS) of the Behavior Assessment System for Children (BASC; Gladman & Lancaster, 2003; Reynolds & Kamphaus, 1992). The child version (appropriate for ages 6 to 11) was used for both the TRS and PRS. The BASC has demonstrated strong reliability (Cronbach's alpha of .80-.89) and construct validity (Sandoval & Echandia, 1994). This study utilized the 34-item PRS externalizing composite score, which was highly reliable (Cronbach's alpha of .91) as well as the 37-item TRS externalizing behavior composite score for analysis, also found to be highly reliable (Cronbach's alpha of .94). Aggression, Conduct Problems, and Hyperactivity scales were used to derive the externalizing behavior composite score.

Parent Rating Scale. Parents completed the 138-item PRS (Reynolds & Kamphaus, 1992), which is comprised of 12 scales (aggression, adaptability, anxiety, attention problems, atypicality, conduct problems, depression, leadership, social skills, hyperactivity, somatization, and withdrawal) and 2 composite scores (externalizing and internalizing). Items of the PRS were rated on a 4-point scale (e.g. "argues with parents" and "interrupts others when they are speaking"; 0 = Never to 3 = Almost Always). The first scale, aggression consisted of 13 items (e.g., "threatens to hurt others," "argues when denied own way") and has demonstrated a good

Cronbach's alpha of .82. The conduct problems scale consisting of 10 items (e.g., "has friends who are in trouble," "has been suspended from school") has demonstrated a Cronbach's alpha of .75. Last, the hyperactivity scale consisted of 11 items (e.g., "cannot wait to take turns," "interrupts others when they are speaking") and has demonstrated a Cronbach's alpha of .83. When all the items for these scales were examined in a reliability analysis, they showed an excellent Cronbach's alpha of .91.

Teacher Rating Scale. Teachers completed the 148-item TRS (Reynolds & Kamphaus, 1992), which was comprised of 14 scales and the same 2 composite scores. Items of the TRS were rated on a 4-point scale (e.g. "threatens to hurt others" and "cheats in school"; 0 = Never to 3 = Almost Always). The first scale, aggression consisted of 14 items (e.g., "blames others," "hits other children") and has demonstrated a good Cronbach's alpha of .91. The conduct problems scale consisting of 10 items (e.g., "shows a lack of concern for others' feelings," "cheats in school") has demonstrated a Cronbach's alpha of .73. Last, the hyperactivity scale consisted of 13 items (e.g., "rushes through assigned work," "calls out in class") and has demonstrated a Cronbach's alpha of .89. When all teacher-reported items were examined in a reliability analysis, they demonstrated an excellent Cronbach's alpha of .94.

Alabama Parenting Questionnaire

The Alabama Parenting Questionnaire (APQ; Shelton et al., 1996) was used to assess parent's self-reported parenting practices. The APQ consists of 42 items rated on a 5-point frequency scale (1 = Never to 5 = Always), and is comprised of five-subscales (Parental Involvement, Positive Parenting, Poor Monitoring and Supervision, Inconsistent Discipline, Corporal Punishment), three of which will be examined as moderators in the current study (Parental Involvement, Poor Monitoring and Supervision, Inconsistent Discipline). In the

literature, three constructs (i.e., warmth, behavioral control, hostile behavior) of parenting behavior have emerged and been utilized in the literature (McKee Colletti, Rakow, Jones, & Forehand, 2008; Schaefer, 1965). Similarly, the three moderators that were used for this study are representative of parental warmth, behavioral control, and discipline practices. Though corporal punishment was well represented in the literature, this scale was excluded from the current study due to a poor Cronbach's alpha of .26.

The first scale, parental involvement consisted of 10 items (e.g., "you have a friendly talk with your child," "you attend PTA meetings, parent/teacher conferences, or other meetings at your child's school") and has demonstrated a good Cronbach's alpha of .79. The Poor Monitoring and Supervision scale consisting of 10 items (e.g., "your child is out with friends you do not know," "your child is at home without adult supervision") has demonstrated a Cronbach's alpha of .66. Last, the inconsistent discipline scale consisted of 6 items (e.g., "you threaten to punish your child and then do not actually punish him/her," "your child is not punished when he/she has done something wrong") and has demonstrated a Cronbach's alpha of .67.

Statistical Analyses

All statistical analyses used in the study were conducted using the *Statistical Package for the Social Sciences (SPSS) software version 24* (SPSS, 2016). To determine whether various demographic variables had significant relationships with any of the study variables, regression analyses were utilized. Any demographic variables that were found to be nonsignificant predictors were removed as covariates in the main analyses. In addition, data were checked for errors and then examined to determine if the assumptions of parametric statistics were tenable. The SPSS macro PROCESS developed by Hayes (2013) was used to explore significant interaction effects and identify regions of significance using the Johnson–Neyman technique.

The Johnson-Neyman technique is available for use with models 1 and 3 in PROCESS (Hayes, 2013) and identifies the value(s) on the moderator variable continuum at which point(s) the effect of the independent variable on the outcome variable transitions between statistically significant and nonsignificant at the .05 level (Hayes, 2013). As for missing data, PROCESS (Hayes, 2013) requires complete data and will automatically eject cases from the data using listwise deletion. Therefore, the sample size for individual analyses varied slightly due to randomly missing data. Table 2 shows the percentage of data missing for each variable. Physiological data made up for the largest percent of missing data, with the percentage of missing data ranging from 13.10% to 21.90%. Missing data was primarily due to errors made during the data collection process (e.g., misplaced electrodes, equipment malfunction). Values for sample sizes analyzed for primary and secondary regression analyses are depicted in Table 3 (moderated regression models) and Table 4 (double moderated regression models). It is important to note that the sample used for different models varied due to missing variable rates. Further, as suggested by Hayes and Cai (2007), a herteroskedasticity-consistent standard error estimator was also utilized. The PROCESS macro determined 95% confidence intervals around scores for the moderator (parenting practices) at which the effect of the focal predictor (autonomic arousal) was statistically significantly associated with the outcome variable (externalizing behavior). Moderator effects were indicated by a significant beta for an interaction variable in the regression equation (Hayes, 2013).

Table 2

Missing Data for Study Variables

Variable	Percent Missing
Gender	0%
Income	0%
Baseline SCL	13.10%
Baseline RSA	15.80%
Parental Involvement	7.20%
Poor Monitoring and Supervision	7.20%
Inconsistent Discipline	7.20%
Parent Rated Externalizing Behavior	0%
Teacher Rated Externalizing Behavior	1.70%
RSA Reactivity	21.90%
SCL Reactivity	16.10%

Table 3

Sample Size Analyzed for Primary Moderated Regression Models

Model	Sample Size Analyzed
Parent Rated Externalizing Behavior	
Baseline SCL × parental involvement	288
Baseline RSA × parental involvement	278
SCL reactivity × parental involvement	277
RSA reactivity × parental involvement	256
Baseline SCL × poor monitoring and supervision	288
Baseline RSA × poor monitoring and supervision	278
SCL reactivity × poor monitoring and supervision	277
RSA reactivity × poor monitoring and supervision	256
Baseline SCL × inconsistent discipline	288
Baseline RSA × inconsistent discipline	278
SCL reactivity × inconsistent discipline	277
RSA reactivity x inconsistent discipline	256
Teacher Rated Externalizing Behavior	
Baseline SCL × parental involvement	283
Baseline RSA × parental involvement	273
SCL reactivity × parental involvement	272
RSA reactivity × parental involvement	252
Baseline SCL × poor monitoring and supervision	283
Baseline RSA × poor monitoring and supervision	273
SCL reactivity × poor monitoring and supervision	272
RSA reactivity × poor monitoring and supervision	252
Baseline SCL × inconsistent discipline	283
Baseline RSA × inconsistent discipline	273
SCL reactivity × inconsistent discipline	272
RSA reactivity x inconsistent discipline	252

Note. Sample size dependent upon data available for variables analyzed

Table 4

Sample Size Analyzed for Secondary Double Moderated Regression Models

Model	Sample Size Analyzed
Parent Rated Externalizing Behavior	
Baseline SCL × parental involvement × gender	288
Baseline RSA × parental involvement × gender	278
Baseline SCL × poor monitoring and supervision × gender	288
Baseline RSA × poor monitoring and supervision × gender	278
Baseline SCL × inconsistent discipline × gender	288
Baseline RSA × inconsistent discipline × gender	278
Baseline SCL × parental involvement × income	288
Baseline RSA × parental involvement × income	278
Baseline SCL × poor monitoring and supervision × income	288
Baseline RSA × poor monitoring and supervision × income	278
Baseline SCL × inconsistent discipline × income	288
Baseline RSA × inconsistent discipline × income	278
Teacher Rated Externalizing Behavior	
Baseline SCL × parental involvement × gender	283
Baseline RSA × parental involvement × gender	273
Baseline SCL × poor monitoring and supervision × gender	283
Baseline RSA × poor monitoring and supervision × gender	273
Baseline SCL × inconsistent discipline × gender	283
Baseline RSA × inconsistent discipline × gender	273
Baseline SCL × parental involvement × income	283
Baseline RSA × parental involvement × income	273
Baseline SCL × poor monitoring and supervision × income	283
Baseline RSA × poor monitoring and supervision × income	273
Baseline SCL × inconsistent discipline × income	283
Baseline RSA × inconsistent discipline × income	273

Note. Sample size dependent upon data available for variables analyzed

Models

Using PROCESS (Hayes, 2013), two-way interactions were analyzed using model 1 (as shown in Figure 3), three-way interactions were analyzed using model 3 (as shown in Figure 4), and bootstrapping bias correction with 95% confidence intervals was employed. Specifically, twelve two-way models (baseline SCL × parental involvement, baseline RSA × parental

involvement, SCL reactivity × parental involvement, RSA reactivity × parental involvement, baseline SCL × poor monitoring and supervision, baseline RSA × poor monitoring and supervision, SCL reactivity × poor monitoring and supervision, RSA reactivity × poor monitoring and supervision, baseline SCL × inconsistent discipline, baseline RSA × inconsistent discipline, SCL reactivity × inconsistent discipline, RSA reactivity x inconsistent discipline) examined parenting practices as a moderator in the relationship between autonomic arousal and parent rated externalizing behavior. Additionally, twelve two-way models (baseline SCL × parental involvement, baseline RSA × parental involvement, SCL reactivity × parental involvement, RSA reactivity × parental involvement, baseline SCL × poor monitoring and supervision, baseline RSA × poor monitoring and supervision, SCL reactivity × poor monitoring and supervision, RSA reactivity × poor monitoring and supervision, baseline SCL × inconsistent discipline, baseline RSA × inconsistent discipline, SCL reactivity × inconsistent discipline, RSA reactivity × inconsistent discipline) examined parenting practices as a moderator in the relationship between autonomic arousal and teacher rated externalizing behavior.

As for the three way models, six three-way interaction terms involving gender (gender × baseline SCL × parental involvement, gender × baseline SCL × poor monitoring and supervision, gender × baseline SCL × inconsistent discipline, gender × baseline RSA × parental involvement, gender × baseline RSA, × poor monitoring and supervision, gender × baseline RSA × inconsistent discipline) were examined with parent rated externalizing behavior and six three-way interaction terms involving gender (gender × baseline SCL × parental involvement, gender × baseline SCL × poor monitoring and supervision, gender × baseline SCL × inconsistent discipline, gender × baseline RSA × parental involvement, gender × baseline RSA, × poor monitoring and supervision, gender × baseline RSA × inconsistent discipline) were examined

with teacher rated externalizing behavior. Finally, six three-way models involving income (income × baseline SCL × parental involvement, income × baseline SCL × poor monitoring and supervision, income × baseline SCL × inconsistent discipline, income × baseline RSA × parental involvement, income × baseline RSA, × poor monitoring and supervision, income × baseline RSA × inconsistent discipline) were examined with parent rated externalizing behavior, and six three-way models involving income (income x baseline SCL × parental involvement, income × baseline SCL × poor monitoring and supervision, income × baseline SCL × inconsistent discipline, income × baseline RSA × parental involvement, income × baseline RSA, × poor monitoring and supervision, income × baseline RSA × inconsistent discipline) were examined with teacher rated externalizing behavior.

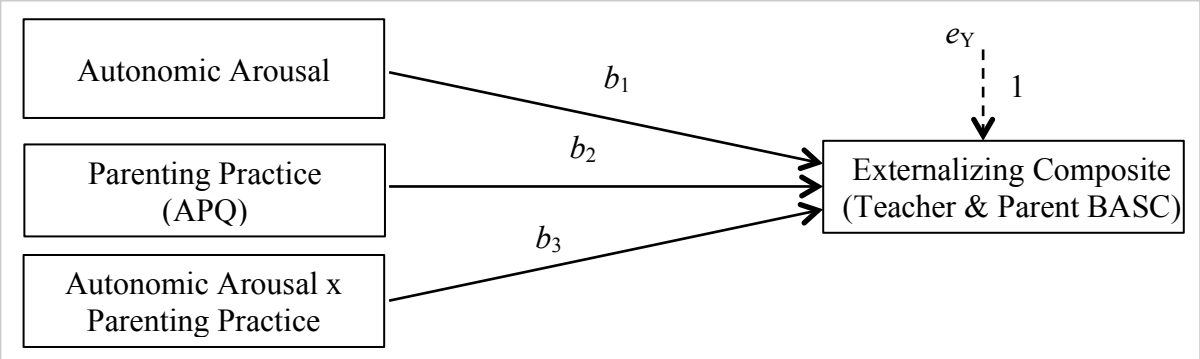

Figure 3: Statistical Model for Moderation within Primary Hypotheses

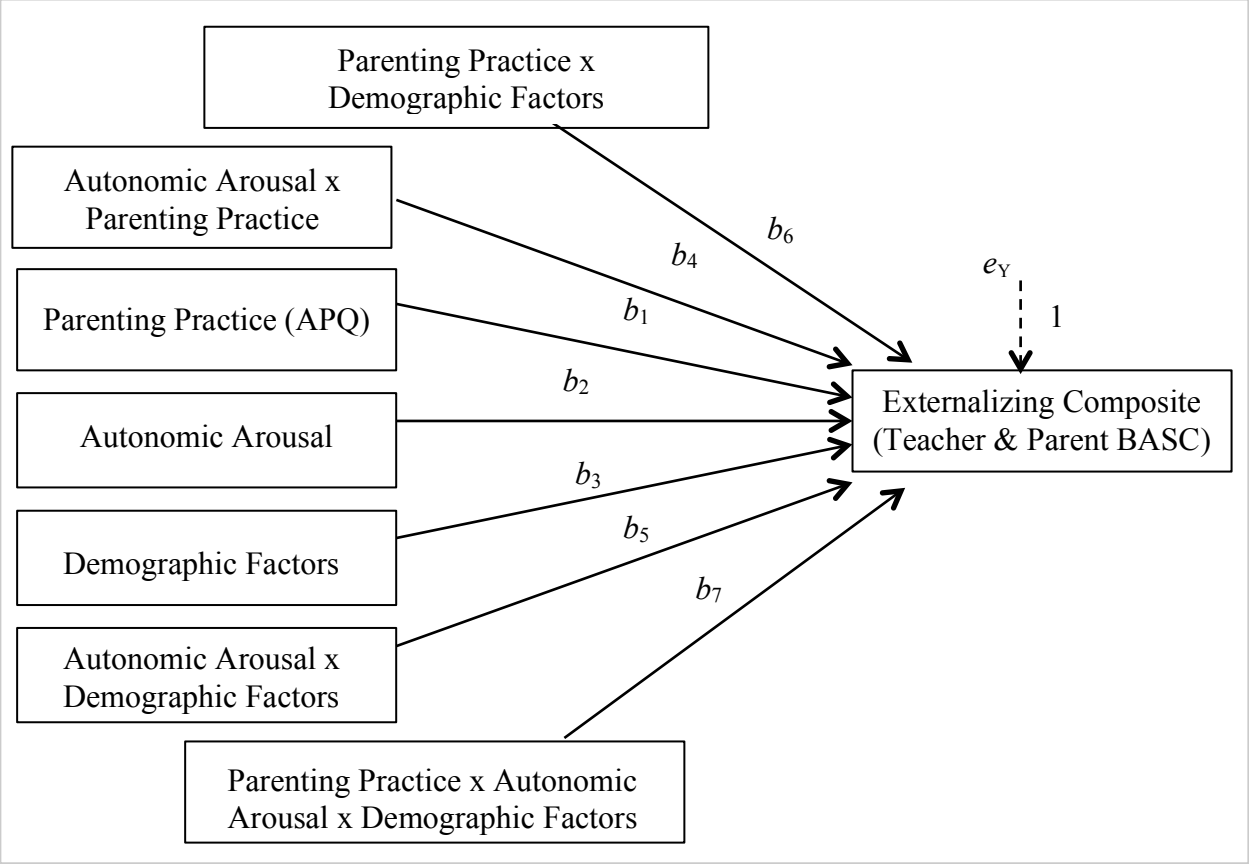

Figure 4: Statistical Model for Double Moderation within Secondary Analyses

Summary

Chapter 3 examined the sample and their demographic characteristics. Study procedures and instrumentation were described and discussed to assist in precise replication of the study. Lastly, the various data analyses that were used in this study were discussed. In the next chapter, the results will be presented.

CHAPTER IV

RESULTS

The current study utilized existing data collected from three hundred sixty child-parent pairs and their public school teachers. As described in Chapter 3, children completed the physiological measures, parents completed three measures (i.e., APQ (Shelton et al., 1996); BASC-PRS (Reynolds & Kamphaus, 1992); demographic measure), and teachers completed the BASC-TRS (Reynolds & Kamphaus, 1992). Moderated multiple regression analyses were employed to examine the association between the independent variables and outcome variables with the interaction of the moderating variables. The outcome variables were parent externalizing behavior and teacher externalizing behavior. The independent variables were baseline SCL, baseline RSA, SCL reactivity, and RSA reactivity. The moderator variables were parental involvement, poor monitoring and supervision, and inconsistent discipline.

This chapter is arranged into two major sections. The first section reports on findings from the study's primary analyses, while the second reports findings from the study's secondary analyses. Specifically, the first section is organized into the following headings: (a) main effects of autonomic arousal, parenting, gender, and income on parent rated externalizing behavior; (b) moderation analyses: parent rated externalizing behavior; (c) moderation analyses for externalizing subscales: parent rated aggression, hyperactivity, and conduct problems; (d) main effects of autonomic arousal, parenting, gender, and income on teacher rated externalizing behavior; (e) moderation analyses: teacher rated externalizing behavior; and (f) moderation analyses for externalizing subscales: teacher rated aggression, hyperactivity, and conduct

problems. The second section reports double moderation findings for gender and double moderation findings for income.

Primary Analyses

The current study examines inconsistent discipline, parental involvement, and poor monitoring and supervision as moderators in the relationship between autonomic arousal (i.e., SCL and RSA) and externalizing behaviors in an at-risk sample of children. Thus, correlations and multiple regression analyses were conducted to investigate whether parenting practices influence the association between autonomic arousal and externalizing behavior in children. This section is divided into two parts. The first examines the aforementioned relationship with parent rated externalizing behavior while the second part examines the relationship with teacher rated externalizing behavior. There were four research questions for the study:

1. Does parenting practice affect the relationship between baseline SCL and externalizing behaviors in children?
2. Does parenting practice affect the relationship between baseline RSA and externalizing behaviors in children?
3. Does parenting practice affect the relationship between SCL reactivity and externalizing behaviors in children?
4. Does parenting practice affect the relationship between RSA reactivity and externalizing behaviors in children?

Bivariate correlations, means, standard deviations, *n*s, skewness, and kurtosis for study variables are presented in Table 5. Correlations revealed that teacher and parent reported externalizing behavior were only slightly positively associated with one another ($r = .292$, $p < .01$), indicating that the teacher and parent reported data measure fairly independent constructs.

Parent reported parenting practices (i.e., parental involvement, poor monitoring and supervision, and inconsistent discipline) were associated with one another, though only weak associations were present indicating independent constructs. Specifically, parental involvement and poor monitoring and supervision were negatively associated with one another (r = -.266, p < .01). Parental involvement and inconsistent discipline were negatively associated with one another (r = -180, p = .001). Last, poor monitoring and supervision and inconsistent discipline (r = .248, p < .01) were positively associated with one another. Parent reported externalizing behavior was found to be negatively correlated with parental involvement (r = -.144, p = .008) and positively correlated with poor monitoring and supervision (r = .261, p < .01), and inconsistent discipline (r = .335, p < .01).

As for measures of autonomic arousal, baseline levels of SCL and RSA were inversely related (r = -.149, p = .011), though no significant correlations were found between RSA reactivity and SCL reactivity, though RSA reactivity was negatively associated with baseline RSA (r = -.516, p < .001). Finally, it is also important to note that no significant correlations were found between autonomic variables and teacher rated externalizing behavior. However, RSA reactivity was positively correlated to parent rated externalizing behavior (r = .136, p = .023).

Table 5

Correlations

	1	2	3	4	5	6	7	8	9
1. SCL baseline	-								
2. RSA baseline	-.149*	-							
3. Parental Involvement	-.098	-.017	-						
4. P. Monitoring	-.061	-.016	-.266**	-					
5. Inconsistent Discipline	.071	-.028	-.180**	.248**	-				
6. P. Ext. Behavior	.071	-.088	-.144**	.261**	.335**	-			
7. T. Ext. Behavior	.035	.043	.026	.088	.028	.292**	-		
8. RSA Reactivity	.040	-.516**	.036	-.012	-.031	.136*	-.029	-	
9. SCL Reactivity	.076	-.025	-.021	-.044	-.017	.059	-.070	.34	-
n	313	303	334	334	334	360	354	281	302
M	7.33	7.46	3.95	1.38	2.44	29.20	41.05	.13	2.32
SD	5.41	1.14	.54	.41	.68	14.30	17.54	.71	2.53
Skewness	1.511	-.224	-.332	1.626	.149	.802	.234	.713	1.028
Kurtosis	2.598	.225	-.243	2.687	-.003	.265	-.313	4.774	2.455

Note. SCL = Skin Conductance Level, RSA = Respiratory Sinus Arrhythmia

*$p < .05$; **$p < .01$

Main Effects of Autonomic Arousal, Parenting, Gender, and Income on Parent Rated Externalizing Behavior

The relationships between autonomic arousal, parenting practices, and parent rated externalizing behavior were assessed using multiple regression analyses. Demographic variables (i.e., gender, income) were entered as control variables. Demographic variables were removed from the final moderated regression model if they did not significantly contribute to the variance in externalizing behavior. A summary of the twelve main effects models for parent rated externalizing behavior is shown in Table 9.

Parental involvement. This subsection is divided into four parts. More specifically, this subsection presents four regression models that include parental involvement, autonomic arousal (i.e., baseline SCL, baseline RSA, SCL reactivity, RSA reactivity), gender, and income as predictors of parent rated externalizing behavior.

Baseline SCL and parental involvement. A multiple linear regression was calculated to predict parent rated externalizing behavior based on parental involvement, gender, and income. A significant regression equation was found ($F(4, 283) = 3.290$, $R^2 = .044$, $p = .012$); the regression results are shown in Table 6. Gender ($B = -3.410$, $SE\ B = 1.659$, $p = .041$) and parental involvement ($B = -3.560$, $SE\ B = 1.460$, $p = .015$) were significant predictors in this model. Demonstrating a significant negative relationship between gender and parent rated externalizing behavior, where higher externalizing behavior was associated with males. Also, a significant negative relationship between parental involvement and parent related externalizing behavior was found; indicating lower parental involvement was associated with higher externalizing behavior.

Baseline RSA and parental involvement. Regression analyses revealed that a model including gender, income, baseline RSA, and parental involvement significantly predicted parent

rated externalizing behavior ($F(4, 273) = 3.582$, $R^2 = .05$, $p = .007$); the regression results are shown in Table 6. Parental involvement was a significant predictor in this model ($B = -3.669$, $SE\ B = 1.682$, $p = .012$) and gender and baseline RSA exhibited non-significant trends for direct effects ($B = -3.170$, $SE\ B = 1.682$, $p = .061$ and $B = -1.209$, $SE\ B = .697$, $p = .084$ respectively). Demonstrating a significant negative relationship between parental involvement and parent rated externalizing behavior, where lower parental involvement was associated with higher externalizing behavior. As for the non-significant trends toward significance, (a) a negative relationship between gender and parent rated externalizing behavior was found, where higher externalizing behavior was associated with the male gender; and (b) a negative relationship between baseline RSA and parent rated externalizing behavior, where higher externalizing behavior was associated with lower baseline RSA.

SCL reactivity and parental involvement. Regression analyses revealed that a model including gender, income, SCL reactivity, and parental involvement significantly predicted parent rated externalizing behavior ($F(4, 272) = 2.923$, $R^2 = .041$, $p = .022$); the regression results are shown in Table 6. Gender ($B = -3.388$, $SE\ B = 1.701$, $p = .047$) and parental involvement were significant predictors in this model ($B = -3.584$, $SE\ B = 1.524$ $p < .01$). This demonstrated a significant negative relationship between gender and parent rated externalizing behavior, where higher externalizing behavior was associated with the male gender. Also, a significant negative relationship between parental involvement and parent rated externalizing behavior was found; indicating lower parental involvement was associated with higher externalizing behavior.

RSA reactivity and parental involvement. Regression analyses revealed that a model including gender, income, RSA reactivity, and parental involvement significantly predicted

parent rated externalizing behavior ($F(4, 251) = 4.202$, $R^2 = .063$, $p = .003$); the regression results are shown in Table 6. Parental involvement ($B = -4.438$, $SE\ B = 1.559$, $p = .005$) and RSA reactivity ($B = 2.343$, $SE\ B = 1.146$, $p = .042$) were significant predictors in this model and gender exhibited a non-significant trend ($B = -3.218$, $SE\ B = 1.761$, $p = .069$). These effects indicated the following: (a) a significant negative relationship between parental involvement and parent rated externalizing behaviors demonstrating higher externalizing behaviors was associated with lower levels of parental involvement; (b) a significant positive relationship between RSA reactivity and parent rated externalizing behaviors, where higher levels of RSA reactivity was associated with higher externalizing behavior; and (c) a non significant negative trend towards significance for gender was found where higher externalizing behavior was associated with the male gender.

Table 6

Regression Analysis Summary for Parental Involvement and Autonomic Arousal's Interaction in Predicting Parent Rated Externalizing Behavior

		B	*SE B*	*t*
$F(4, 283) = 3.290$, $R^2 = .044$, $p = .012$				
	Gender	-3.410	1.659	-2.056*
	Income	-.997	1.642	-.607
	P. Involvement	-3.560	1.460	-2.438*
	Baseline SCL	.159	.146	1.092
$F(4, 273) = 3.582$, $R^2 = .05$, $p = .007$				
	Gender	-3.170	1.682	-1.884†
	Income	1.453	1.661	-.875
	P. Involvement	-3.669	1.454	-2.523*
	Baseline RSA	-1.209	.697	-1.735†
$F(4, 272) = 2.923$, $R^2 = .041$, $p = .022$				
	Gender	-3.388	1.701	-1.992*
	Income	-.871	1.676	-.520
	P. Involvement	-3.584	1.524	-2.352*
	SCL Reactivity	.317	.308	1.027
$F(4, 251) = 4.202$, $R^2 = .063$, $p = .003$				
	Gender	-3.218	1.761	-1.827†
	Income	-1.373	1.740	-.867
	P. Involvement	-4.328	1.559	-2.847**
	RSA Reactivity	2.343	1.146	2.044*

Note. B = unstandardized regression coefficient, *SE B* = standard error of the unstandardized regression coefficient

†$p < .10$ *$p < .05$ **$p < .01$

Poor monitoring and supervision. This subsection is divided into four parts. More specifically, this subsection presents four regression models that include poor monitoring and supervision, autonomic arousal (i.e., baseline SCL, baseline RSA, SCL reactivity, RSA reactivity), gender, and income as predictors of parent rated externalizing behavior.

Baseline SCL and poor monitoring and supervision. Regression analyses revealed that a model including gender, income, baseline SCL, and poor monitoring and supervision

significantly predicted parent rated externalizing behavior ($F(4, 283) = 7.139$, $R^2 = .092$, $p <$ .01); the regression results are shown in Table 7. Poor monitoring and supervision was a significant predictor in this model ($B = 8.496$, $SE\ B = 1.855$, $p < .01$) and gender exhibited a non-significant trend ($B = 3.071$, $SE\ B = 1.619$, $p = .059$). This demonstrated a significant positive relationship between poor monitoring and supervision and parent rated externalizing behavior, where externalizing behavior was higher when monitoring and supervision was low. Also, a non-significant negative trend towards significance between gender and parent rated externalizing behavior showed externalizing behavior was higher for males.

Baseline RSA and poor monitoring and supervision. Regression analyses revealed that a model including gender, income, baseline RSA, and poor monitoring and supervision significantly predicted parent rated externalizing behavior ($F(4, 273) = 10.385$, $R^2 = .128$, $p <$ .01); the regression results are shown in Table 7. Poor monitoring and supervision was a significant predictor in this model ($B = 8.640$, $SE\ B = 1.965$, $p < .01$), while gender and baseline RSA exhibited a non-significant trend ($B = -2.888$, $SE\ B = 1.646$, $p = .081$ and $B = -1.120$, $SE\ B = .681$, $p = .10$ respectively). This demonstrated a significant positive relationship between poor monitoring and supervision and parent rated externalizing behavior, where less monitoring and supervision resulted in higher externalizing behavior. Additionally, a non-significant negative trend towards significance was found where higher externalizing behavior was associated with males and a non-significant negative trend towards significance was found where higher externalizing behavior was associated with lower baseline RSA.

SCL reactivity and poor monitoring and supervision. Regression analyses revealed that a model including gender, income, SCL reactivity, and poor monitoring and supervision significantly predicted parent rated externalizing behavior ($F(4, 272) = 6.358$, $R^2 = .085$, $p <$

.01); the regression results are shown in Table 7. Poor monitoring and supervision was a significant predictor in this model (B = 8.274, $SE\ B$ = 1.900, $p < .01$) and gender exhibited a non-significant trend (B = -3.127, $SE\ B$ = 1.662, p = .061). This demonstrated a significant positive relationship between poor monitoring and supervision and parent rated externalizing behavior, where less monitoring and supervision was associated with higher externalizing behavior. Also, a non-significant negative trend towards significance was found where higher levels of externalizing behavior were associated with the male gender.

RSA reactivity and poor monitoring and supervision. Regression analyses revealed that a model including gender, income, RSA reactivity, and poor monitoring and supervision significantly predicted parent rated externalizing behavior ($F(4, 251) = 7.039$, $R^2 = .101$, $p < .01$); the regression results are shown in Table 7. Poor monitoring and supervision (B = 8.865, $SE\ B$ = 2.029, $p < .01$) and RSA reactivity (B = 2.254, $SE\ B$ = 1.122, p = .046) were significant predictors in this model and gender exhibited a non-significant trend (B = -3.192, $SE\ B$ = 1.720, p = .065). These results indicated the following: (a) a significant positive relationship between poor monitoring and supervision and parent rated externalizing behaviors where less monitoring and supervision was associated with higher externalizing behavior; (b) a significant positive relationship between RSA reactivity and parent rated externalizing behaviors, where higher levels of RSA reactivity resulted in higher externalizing behavior; and (c) a non-significant trend towards negative significance for gender was found where higher externalizing behavior was associated with the male gender.

Table 7

Regression Analysis Summary for Poor Monitoring and Supervision and Autonomic Arousal's Interaction in Predicting Parent Rated Externalizing Behavior

	B	*SE B*	*t*
$F(4, 283) = 7.139$, $R^2 = .092$, $p < .01$			
Gender	-3.071	1.619	-1.897†
Income	-.259	1.612	-.161
Poor Monitoring	8.496	1.855	4.579**
Baseline SCL	.226	.141	1.598†
$F(4, 273) = 10.385$, $R^2 = .128$, $p < .01$			
Gender	-2.888	1.646	-1.754†
Income	-.305	1.648	-.185
Poor Monitoring	8.640	1.965	4.396**
Baseline RSA	-1.120	.681	-1.643†
$F(4, 272) = 6.358$, $R^2 = .085$, $p < .01$			
Gender	-3.127	1.662	-1.882†
Income	-.098	1.649	-.059
Poor Monitoring	8.274	1.900	4.356**
SCL Reactivity	.393	.301	1.303
$F(4, 251) = 7.039$, $R^2 = .101$, $p < .01$);			
Gender	-3.192	1.720	-1.856†
Income	-.301	1.732	-.174
Poor Monitoring	8.865	2.029	4.369**
RSA Reactivity	2.254	1.122	2.009*

†$p < .10$ *$p < .05$ **$p < .01$

Inconsistent discipline. This subsection is divided into four parts. More specifically, this subsection presents four regression models that include inconsistent discipline, autonomic arousal (i.e., baseline SCL, baseline RSA, SCL reactivity, RSA reactivity), gender, and income as predictors of parent rated externalizing behavior.

Baseline SCL and inconsistent discipline. Regression analyses revealed that a model including gender, income, baseline SCL, and inconsistent discipline significantly predicted

parent rated externalizing behavior ($F(4, 283) = 10.385$, $R^2 = .128$, $p < .01$); the regression results are shown in Table 8. Gender ($B = -3.873$, $SE\ B = 1.581$, $p = .015$) and inconsistent discipline were significant predictors in this model ($B = 6.264$, $SE\ B = 1.080$, $p < .01$). This demonstrated a significant negative relationship between gender and parent rated externalizing behavior, showing greater externalizing behavior was associated with the male gender. Additionally, a significant positive relationship between inconsistent discipline and parent externalizing behaviors was found, indicating that higher externalizing behaviors are associated with higher levels of inconsistent discipline.

Baseline RSA and inconsistent discipline. Regression analyses revealed that a model including gender, income, baseline RSA, and inconsistent discipline significantly predicted parent rated externalizing behavior ($F(4, 273) = 10.385$, $R^2 = .128$, $p < .01$); the regression results are shown in Table 8. Gender ($B = -3.393$, $SE\ B = 1.610$, $p = .036$) and inconsistent discipline were significant predictors in this model ($B = 6.306$, $SE\ B = 1.134$, $p < .01$). Similar to the previous model, a significant negative relationship between gender and parent rated externalizing behavior was generated, demonstrating higher externalizing behavior was associated with males. Also, a significant positive relationship between inconsistent discipline and parent externalizing behaviors showed higher externalizing behaviors are associated with higher levels of inconsistent discipline.

SCL reactivity and inconsistent discipline. Regression analyses revealed that a model including gender, income, SCL reactivity, and inconsistent discipline significantly predicted parent rated externalizing behavior ($F(4, 272) = 10.391$, $R^2 = .133$, $p < .01$); the regression results are shown in Table 8. Gender ($B = -3.893$, $SE\ B = 1.614$, $p = .016$) and inconsistent discipline were significant predictors in this model ($B = 6.417$, $SE\ B = 1.088$, $p < .01$). Similar to the

previous inconsistent discipline models, a significant negative relationship between gender and parent rated externalizing behavior was found, demonstrating higher externalizing behavior for males. Also, a significant positive relationship between inconsistent discipline and parent externalizing behaviors show that higher externalizing behaviors are associated with higher levels of inconsistent discipline.

RSA reactivity and inconsistent discipline. Regression analyses revealed that a model including gender, income, RSA reactivity, and inconsistent discipline significantly predicted parent rated externalizing behavior ($F(4, 251) = 10.764$, $R^2 = .146$, $p < .01$); the regression results are shown in Table 8. Gender ($B = -3.817$, $SE\ B = 1.672$, $p = .023$), inconsistent discipline ($B = 6.748$, $SE\ B = 1.166$, $p < .01$), and RSA reactivity ($B = 2.407$, $SE\ B = 1.094$, $p = .029$) were significant predictors in this model. This indicated the following: (a) a significant negative relationship between gender and parent rated externalizing behavior, where higher externalizing behavior was associated with the male gender; (b) a significant positive relationship between inconsistent discipline and parent externalizing behaviors shows higher externalizing behaviors are associated with higher levels of inconsistent discipline; and (c) a significant positive relationship between RSA reactivity and parent rated externalizing behavior, where higher externalizing behavior was associated with higher levels of RSA reactivity.

Table 8

Regression Analysis Summary for Inconsistent Discipline and Autonomic Arousal's Interaction in Predicting Parent Rated Externalizing Behavior

	B	*SE B*	*t*
$F(4, 283) = 10.385$, $R^2 = .128$, $p < .01$			
Gender	-3.873	1.581	-2.449*
Income	-.204	1.576	-.129
Inconsistent Discipline	6.264	1.080	5.799**
Baseline SCL	.123	.139	.884
$F(4, 273) = 10.385$, $R^2 = .128$, $p < .01$			
Gender	-3.393	1.610	-2.107*
Income	-.603	1.601	-.377
Inconsistent Discipline	6.306	1.134	5.561**
Baseline RSA	-1.052	.699	-1.573
$F(4, 272) = 10.391$ $R^2 = .133$, $p < .01$			
Gender	-3.893	1.614	-2.413*
Income	-.050	1.602	-.031
Inconsistent Discipline	6.417	1.088	5.895**
SCL Reactivity	.357	.293	1.219
$F(4, 251) = 10.764$, $R^2 = .146$, $p < .01$			
Gender	-3.817	1.672	-2.283*
Income	-.784	1.667	-.470
Inconsistent Discipline	6.748	1.166	5.788**
RSA Reactivity	2.407	1.094	2.200*

$^{\dagger}p < .10$ $*p < .05$ $**p < .01$

Summary. Regression analyses revealed that parenting practices and gender are consistent significant predictors of externalizing behavior. Specific to gender, overall, males are associated with higher levels of parent rated externalizing behavior. Additionally, baseline RSA and RSA reactivity were also predictors of parent rated externalizing behavior. A summary of the main effects of parenting, autonomic arousal, gender, and income on parent rated externalizing behavior is shown in Table 9.

Table 9

Summary of Main Effects of Autonomic Arousal, Parenting, Gender, and Income on Higher Levels of Parent Rated Externalizing Behavior

	Parental Involvement	Poor Monitoring and Supervision	Inconsistent Discipline
Baseline SCL	Low parental involvement* Males*	Low monitoring and supervision** Males†	Inconsistent Discipline** Males*
Baseline RSA	Low parental involvement** Males† Low baseline RSA†	Low monitoring and supervision** Males† Low baseline RSA†	Inconsistent Discipline** Males*
SCL Reactivity	Low parental involvement** Males*	Low monitoring and supervision** Males†	Inconsistent Discipline** Males*
RSA Reactivity	Low parental involvement** Males† High RSA reactivity*	Low monitoring and supervision** Males† High RSA reactivity*	Inconsistent Discipline** Males* High RSA reactivity*

†slope *at* $p < .10$ *significant slope at $p < .05$ **significant slope at $p < .01$

Moderation Analyses: Parent Rated Externalizing Behavior

In the following analyses gender and yearly household income were entered as control variables unless they did not contribute significantly to the model, in which case they were removed to ensure better model fit. A summary of the results for the four moderation models for parental involvement is shown in Table 10, while the four moderation models for poor monitoring and supervision are shown in Table 8. The four moderation models for inconsistent discipline are shown in Table 12.

Table 10

Moderated Regression Analysis Summary for Parental Involvement and Autonomic Arousal's Interaction in Predicting Parent Rated Externalizing Behavior

		B	*SE B*	*t*	95% CI
R^2 = .048, *MSE* = 171.01, *p* = .01					
Intercept	i_1	56.4698	10.9115	5.1752**	[34.9917, 77.9479]
Baseline SCL (X)	b_1	-1.2028	1.2318	-.9765	[-3.6274, 1.2218]
P. Involvement (M)	b_2	-6.2445	2.7816	-2.2449*	[-11.7199, -.7692]
X × M	b_3	.3444	.3220	1.0696	[-.2894, .9783]
R^2 = .0397, *MSE* = 175.994, *p* = .0134		11.7827	40.8242	.2886	[-68.5863, 92.1518]
Intercept	i_1	-1.4193	1.3803	-1.0283	[-4.1366, 1.2980]
Baseline RSA (X)	b_1	4.3973	5.4529	.8064	[-6.3376, 15.1322]
P. Involvement (M)	b_2	6.6320	10.3416	.6413	[-13.7271, 26.9910]
X × M	b_3	-1.4193	1.3803	-1.0283	[-4.1366, 1.2980]
R^2 = .0403, *MSE* = 175.8102, *p* = .0183					
Intercept	i_1	47.4304	8.8943	5.3327**	[29.9200, 64.9409]
SCL Reactivity (X)	b_1	.0131	2.3102	.0057	[-4.65350, 4.5613]
P. Involvement (M)	b_2	-3.8003	2.1976	-1.7293†	[-8.1268, .5262]
X × M	b_3	.0767	.5766	.1330	[-1.0585, 1.2119]
R^2 = .0499, *MSE* = 177.6862, *p* = .0041					
Intercept	i_1	47.7983	6.0426	7.9102**	[35.8979, 59.6987]
RSA Reactivity (X)	b_1	-2.7895	9.1631	-.3044	[-20.8355, 15.2566]
P. Involvement (M)	b_2	-4.8889	1.5245	-3.2070**	[-7.8913, -1.8866]
X × M	b_3	1.2575	2.3047	.5456	[-3.2814, 5.7963]

†$p < .10$ *$p < .05$ **$p < .01$

RSA reactivity and poor monitoring and supervision. The interaction between RSA reactivity and poor monitoring and supervision was tested, but was found to be non-significant (results are shown in Table 11). A plot of the relationship (Figure 5) is included as there were regions of significance reported by the Johnson-Neyman technique (Hayes, 2013). The Johnson-Neyman technique (Hayes, 2013) is used to identify the values on the continuum of parental involvement at which point the effect of RSA reactivity on parent rated externalizing behavior transitions between statistically significant and nonsignificant at the .05 level. This technique

used for determining regions of significance indicated significant conditional effects of poor monitoring and supervision at levels between 1.3271 ($t(252) = 1.9694$, p = .05, $B = 2.2010$) and 2.2855 ($t(252) = 1.9694$, p = .05, $B = 5.3081$).

Table 11

Moderated Regression Analysis Summary for Poor Monitoring and Supervision and Autonomic Arousal's Interaction in Predicting Parent Rated Externalizing Behavior

		B	*SE B*	*t*	95% CI
$R^2 = .0847$, $MSE = 163.85$, $p < .01$					
Intercept	i_1	10.8545	3.8030	2.8542**	[3.3689, 18.3402]
Baseline SCL (X)	b_1	.7934	.5245	1.5125†	[-.2391, 1.8258]
P. Monitoring (M)	b_2	11.6789	2.4623	4.7430**	[6.831, 16.5257]
X × M	b_3	-.4023	.467	-1.1606	[-1.0847, .2800]
$R^2 = .0824$, $MSE = 168.1595$, $p < .01$					
Intercept	i_1	18.7923	15.6924	1.1975	[-12.1008, 49.6854]
Baseline RSA (X)	b_1	-.2633	2.0880	-.1261	[-4.3738, 3.8473]
P. Monitoring (M)	b_2	13.8902	10.6126	1.3088	[-7.0024, 34.7827]
X × M	b_3	-.6805	1.4141	-.4812	[-3.4644, 2.1033]
$R^2 = .0757$, $MSE = 168.7028$, $p < .01$					
Intercept	i_1	17.7902	3.0996	5.7396**	[11.6881, 23.8923]
SCL Reactivity (X)	b_1	-.4138	.9302	-.4448	[-2.2450, 1.4175]
P. Monitoring (M)	b_2	7.2091	2.0295	3.5522**	[3.2136, 11.2045]
X × M	b_3	.6145	.6462	.9510	[-.6577, 1.8867]
$R^2 = .0923$, $MSE = 169.7457$, $p < .01$					
Intercept	i_1	16.0641	2.5867	6.2103**	[10.9698, 21.1584]
RSA Reactivity (X)	b_1	-2.1013	3.7127	-.5660	[-9.4132, 5.2105]
P. Monitoring (M)	b_2	9.0470	1.7442	5.1868**	[5.6119, 12.4821]
X × M	b_3	3.2419	2.6228	1.2361	[-1.9234, 8.4072]

†$p < .10$ *$p < .05$ **$p < .01$

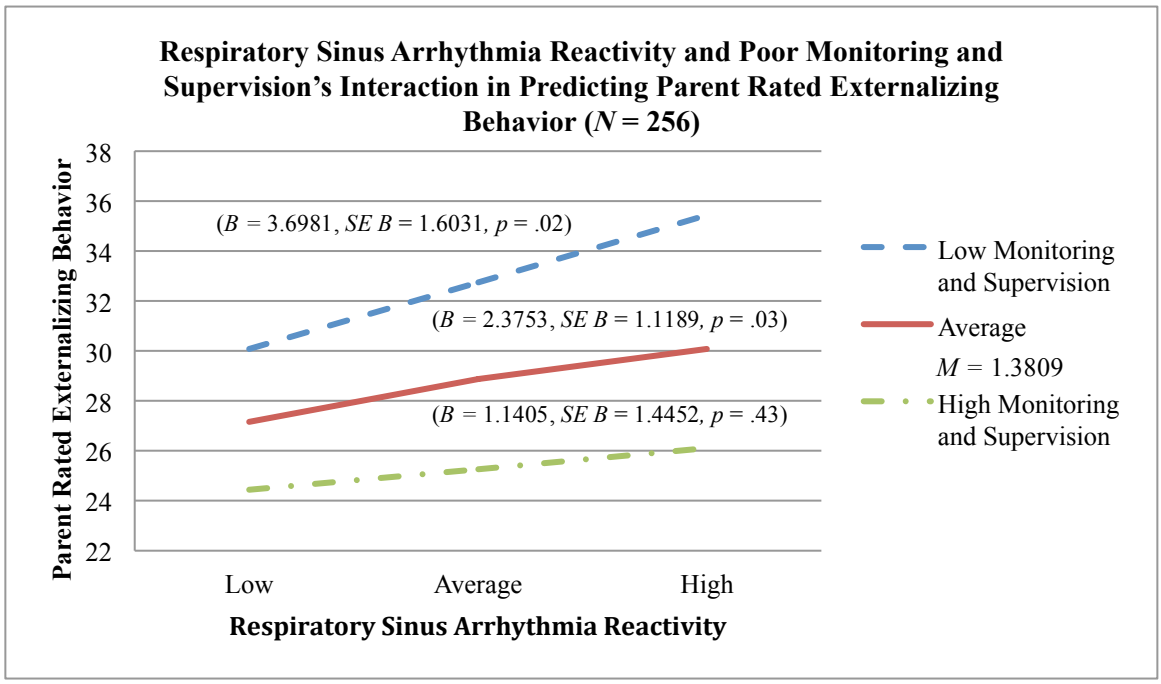

Figure 5: Respiratory Sinus Arrhythmia Reactivity and Poor Monitoring and Supervision's Interaction in Predicting Parent Rated Externalizing Behavior ($N = 256$)

Table 12

Moderated Regression Analysis Summary for Inconsistent Discipline and Autonomic Arousal's Interaction in Predicting Parent Rated Externalizing Behavior

		B	*SE B*	*t*	95% CI
$R^2 = .1306$, $MSE = 156.179$, $p < .01$					
Intercept	i_1	21.1441	5.1712	4.0888**	[10.9652, 31.3230]
Baseline SCL (X)	b_1	-.3054	.5795	-.5271	[-1.4460, .8352]
Inconsistent Discipline (M)	b_2	4.8864	1.7658	2.7672**	[1.4106, 8.3622]
X × M	b_3	.1731	.2454	.8035	[-.2510, .5972]
$R^2 = .1301$, $MSE = 160.0153$, $p < .01$					
Intercept	i_1	45.3432	20.1633	2.2488*	[5.6478, 85.0386]
Baseline RSA (X)	b_1	-3.6100	2.5709	-1.4042	[-8.6714, 1.4514]
Inconsistent Discipline (M)	b_2	-1.7960	8.1990	-.2191	[-17.9373, 14.3453]
X × M	b_3	1.0874	1.0537	1.0320	[-.9870, 3.1617]
$R^2 = .1326$, $MSE = 158.9107$, $p < .01$					
Intercept	i_1	17.4657	4.3376	4.0266**	[8.9263, 26.0052]
SCL Reactivity (X)	b_1	.3967	.9861	.4023	[-1.5446, 2.3380]
Inconsistent Discipline (M)	b_2	6.4595	1.5198	4.2504**	[3.4676, 9.4515]
X × M	b_3	-.0163	.4219	-.0387	[-6.9827, .-.7925]
$R^2 = .1457$, $MSE = 160.4051$, $p < .01$					
Intercept	i_1	16.9703	3.6717	4.6220**	[9.7391, 24.2015]
RSA Reactivity (X)	b_1	2.2496	5.1776	.4345	[-7.9475, 12.4467]
Inconsistent Discipline (M)	b_2	6.7919	1.0812	6.2820**	[4.6626, 8.9212]
X × M	b_3	.0634	2.1073	.0301	[-4.0869, 4.2136]

$^{\dagger}p < .10$ *$p < .05$ **$p < .01$

Summary. Twelve moderated regression analyses were examined in this section. Parenting practices were examined as moderators of the relationships between autonomic arousal and parent rated externalizing behavior. None of the interaction effects between autonomic arousal and each of the three parenting practices produced significant outcomes.

Moderation Analyses for Externalizing Subscales: Parent Rated Aggression, Hyperactivity, and Conduct Problems

The outcome variable examined in the primary analyses was conducted with a composite score, which was comprised of three scales (i.e., aggression, hyperactivity, conduct problems). Although no interaction effects were found between autonomic arousal and the three parenting practices as predictors of parent reported externalizing behavior, some significant interactions were found when examining the scales individually. Bivariate correlations, means, standard deviations, *n*s, skewness, and kurtosis for study variables including the three BASC scales (i.e., aggression, hyperactivity, conduct problems) are presented in Table 13. Correlations revealed that parent rated aggression was positively associated with both parent reported conduct problems ($r = .744$, $p < .01$) and parent rated hyperactivity ($r = .699$, $p < .01$). In addition, parent reported hyperactivity was also positively associated with parent rated conduct problems ($r = .640$, $p < .01$). These findings indicated that parent rated scales were strongly correlated, but with room for variability within and between scales. A summary of significant results for parent rated externalizing subscales is shown in Table 17.

Table 13

Correlations with Externalizing Subscales

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. SCL baseline	-												
2. RSA baseline	-.149*	-											
3. P. Involvement	-.098	-.017	-										
4. P. Monitoring	-.061	-.016	-.266**	-									
5. Inconsistent Disc.	.071	-.028	-.180**	.248**	-								
6. P. Aggression	.049	-.063	-.137**	.261**	.309**	-							
7. P. Conduct Problems	.066	-.072	-.21	.293**	.274**	.744**	-						
8. P. Hyperactivity	.075	-.099	-.062	.178**	.307**	.699**	.640**	-					
9. T. Aggression	.009	.056	.046	.075	.957	.216**	.297**	.183**	-				
10. T. Conduct Problems	.04	.057	-.08	.128*	.073	.243**	.403**	.235**	.689**	-			
11. T. Hyperactivity	.049	.01	.047	.059	.025	.145**	.264**	.252**	.708**	.526*	-		
12. RSA Reactivity	.040	-.516**	.036	-.012	-.031	.114	.093	.148**	-.030	-.036	-.015	-	
13. SCL Reactivity	.076	-.025	-.021	-.044	-.017	.056	.034	.062	-.073	-.042	-.059	-.034	-
n	313	303	334	334	334	360	360	360	354	354	354	281	302
M	7.36	7.46	3.95	1.38	2.44	11.94	6.92	10.34	17.66	5.72	17.68	.1335	2.3197
SD	5.41	1.14	0.54	.41	.68	5.87	4.29	5.865	8.17	3.63	7.989	.708	2.525
Skewness	1.511	-.224	-.332	1.626	.149	.838	1.062	.727	0.198	0.917	0.156	.713	1.028
Kurtosis	2.598	.225	-.243	2.687	-.003	0.41	1.132	.089	-0.425	0.854	-0.602	4.774	2.455

Note. SCL = Skin Conductance Level; RSA = Respiratory Sinus Arrhythmia
*$p < .05$; **$p < .01$

Parent rated conduct problems. Regression analyses revealed that a model including gender, income, baseline SCL, and parental involvement significantly predicted parent rated conduct problems ($F(4, 283) = 6.985$, $R^2 = .090$, $p < .01$); the regression results are shown in Table 14. Gender ($B = -1.368$, $SE\ B = .492$, $p = .006$), income ($B = -.994$, $SE\ B = .487$, $p = .042$), and parental involvement ($B = -1.569$, $SE\ B = .433$, $p < .01$) were significant predictors in this model. This demonstrated a significant negative relationship between gender and parent rated conduct problems, showing greater conduct problems was associated with the male gender. Additionally, a significant negative relationship between yearly household income and parent rated conduct problems were found, indicating that higher levels of parent rated conduct problems are associated with children in households with yearly income less than $30,000. Finally, a significant negative relationship between parental involvement and parent rated conduct problems was found, indicating that higher conduct problems are associated with lower levels of parental involvement.

After controlling for gender and income, the interaction between parental involvement and baseline SCL in predicting parent rated conduct problems exhibited a non-significant trend ($B = .1611$, $SE = .0927$, $p = .083$, 95% CI = [-.0213, .2424]). The overall model accounted for 12% of the total variance of parent rated conduct problems ($F(5, 282) = 6.458$, $p < .001$); regression results are shown in Table 14. The Johnson-Neyman technique (Hayes, 2013) used for determining regions of significance indicated significant conditional effects of parental involvement at levels above 4.568 ($t(282) = 1.9684$, $p = .05$, $B = .1661$). A plot of the interaction indicated that baseline SCL was negatively associated with parent rated conduct problems in the presence of low parental involvement (1 standard deviation below the mean), but positively

associated with parent rated conduct problems in the presence of high parental involvement (1 standard deviation above the mean; Figure 6).

Table 14

Regression Analysis Summary for Baseline Skin Conductance and Parental Involvement's Interaction in Predicting Parent Rated Conduct Problems (N = 288)

Variable		*B*	*SE B*	*t*	95% CI
Main Effects Model					
$R^2 = .090$, *MSE* = 105.593, $p < .001$					
Gender		-1.368	.492	-2.779**	---
Income		-.994	.487	-2.039*	---
P. Involvement		-1.569	.433	-3.621**	---
Baseline SCL		.053	.043	1.224	---
Parental Involvement Moderation Model					
$R^2 = .1154$, *MSE* = 14.7461, $p < .001$					
Intercept	i_1	20.1914	3.6290	5.5638**	[13.0480, 27.3348]
Baseline SCL (X)	b_1	-.5697	.3566	-3.0874	[-1.2715, .1322]
P. Involvement (M)	b_2	-2.7341	.8856	-2.4338*	[-4.4773, -.9910]
X × M	b_4	.1611	.0927	1.7382†	[-.0213, .3434]

†$p < .10$ *$p < .05$ **$p < .01$

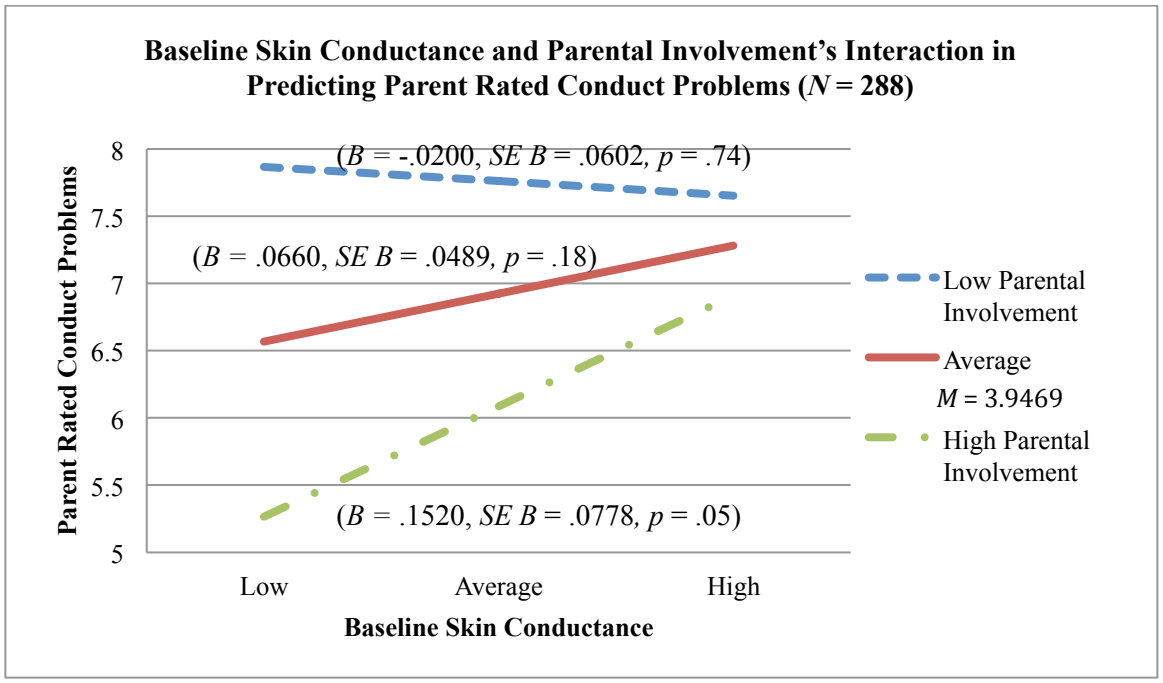

Figure 6: Baseline Skin Conductance and Parental Involvement's Interaction in Predicting Parent Rated Conduct Problems (*N* = 288)

Parent rated hyperactivity. Regression analyses revealed that a model including gender, income, baseline RSA, and inconsistent discipline significantly predicted parent rated hyperactivity ($F_{(4, 273)} = 8.656$, $R^2 = .335$, $p < .01$); the regression results are shown in Table 15. Inconsistent discipline ($B = 2.494$, $SE\ B = .481$, $p < .01$) was a significant predictor in this model. This demonstrated a significant positive relationship between inconsistent discipline and parent rated hyperactivity, indicating that higher levels of parent rated hyperactivity were associated with higher levels of inconsistent discipline. Additionally, gender and baseline RSA exhibited a non-significant trend ($B = -1.208$, $SE\ B = .682$, $p = .078$ and $B = -.506$, $SE\ B = .481$, $p = .075$ respectively). This demonstrated a non-significant negative trend towards significance, where higher levels of parent rated hyperactivity was associated with males and lower baseline RSA.

When inconsistent discipline was examined as a moderator in the relationship between baseline RSA and parent rated hyperactivity, a non-significant trend was found ($B = .6786$, $SE = .3582$, $p = .059$, 95% CI = [-.0265, 1.3837]). The overall model accounted for 11% of the total variance of parent rated hyperactivity ($F_{(3, 274)} = 15.5439$, $p < .001$); regression results are shown in Table 15. The Johnson-Neyman technique (Hayes, 2013) used for determining regions of significance indicated significant conditional effects of inconsistent discipline at levels below 2.2975 ($t(274) = -1.9687$, p =.05, $B = -.6027$). A plot of the interaction indicated that baseline RSA was negatively associated with parent rated hyperactivity regardless of the level of inconsistent discipline (Figure 7).

Table 15

Regression Analysis Summary for Baseline Respiratory Sinus Arrhythmia and Inconsistent Discipline's Interaction in Predicting Parent Rated Hyperactivity (N = 278)

Variable		*B*	*SE B*	*t*	95% CI
Main Effects Model					
$R^2 = .113$, $MSE = 249.773$, $p < .001$					
Gender		-1.208	.682	-1.770†	---
Income		.376	.679	.555	---
Inconsistent Discipline		2.494	.481	5.189**	---
Baseline RSA		-.506	.283	-1.786†	---
Inconsistent Discipline Moderation Model					
$R^2 = .1091$, $MSE = 28.8595$, $p < .001$					
Intercept	i_1	20.5348	7.3752	2.7843**	[6.0155, 35.0541]
Baseline RSA (X)	b_1	-2.1616	.9300	-2.3243*	[-3.9925, -.3307]
Inconsistent Discipline (M)	b_2	-2.6267	2.8086	-.9352	[-8.1558, 2.9025]
X × M	b_4	.6786	.3582	1.8945†	[-.0265, 1.3837]

†$p < .10$ *$p < .05$ **$p < .01$

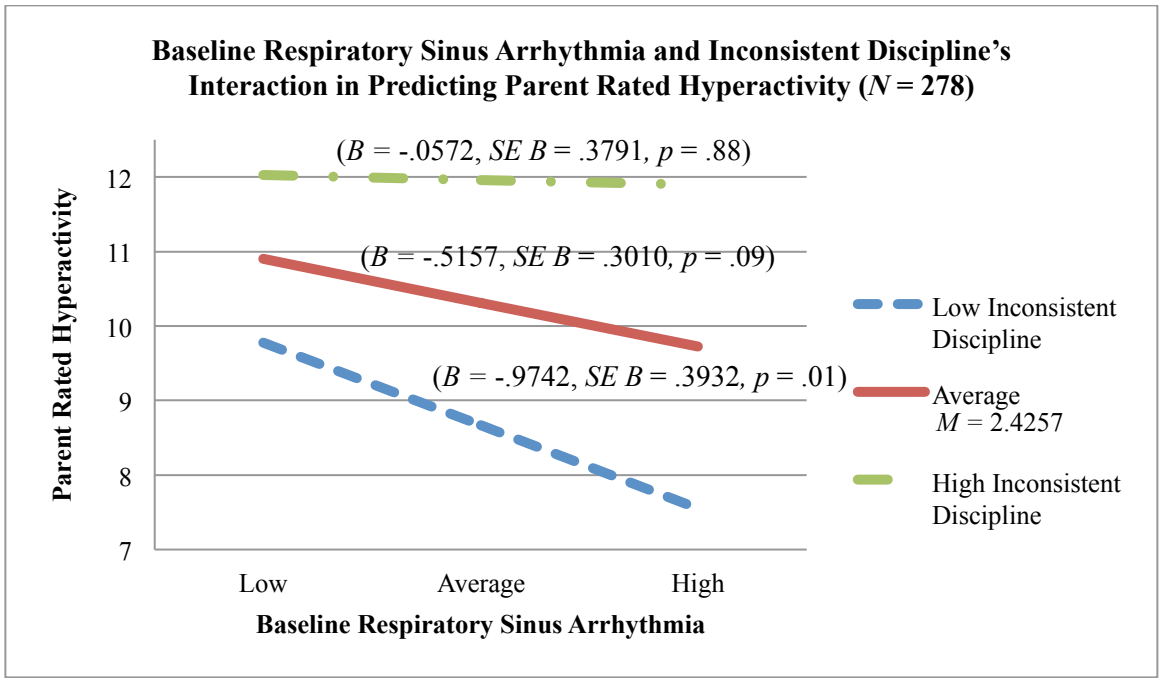

Figure 7: Baseline Respiratory Sinus Arrhythmia and Inconsistent Discipline's Interaction in Predicting Parent Rated Hyperactivity ($N = 278$)

Parent rated aggression. Regression analyses revealed that a model including gender, income, SCL reactivity, and poor monitoring and supervision significantly predicted parent rated aggression ($F(4, 272) = 5.250$, $R^2 = .072$, $p < .01$); the regression results are shown in Table 15.

Poor monitoring and supervision (B = 3.300, $SE\ B$ = .775, p < .01) was a significant predictor in this model. This demonstrated a significant positive relationship between poor monitoring and supervision and parent rated aggression, indicating that higher levels of parent rated aggression are associated with higher lower monitoring and supervision.

When poor monitoring and supervision was examined as a moderator in the relationship between SCL reactivity and parent rated aggression, a non-significant trend was found (B = .5428, SE = .2774, p = .0515, 95% CI = [-.0035, 1.0892]). The overall model accounted for 8% of the total variance of parent rated aggression ($F(3, 273)$ = 8.2790, p < .001); regression results are shown in Table 16. The Johnson-Neyman technique (Hayes, 2013) used for determining regions of significance indicated significant conditional effects of poor monitoring and supervision at levels above 1.5055 ($t(273)$ = 1.9687, p =.05, B = .2465). A plot of the interaction indicated that SCL reactivity was negatively associated with parent rated aggression in the presence of high monitoring and supervision, but positively associated with parent rated aggression in the presence of low parental monitoring and supervision (Figure 8).

Table 16

Regression Analysis Summary for Skin Conductance Reactivity and Poor Monitoring and Supervision's Interaction in Predicting Parent Rated Aggression (N = 277)

Variable		*B*	*SE B*	*t*	95% CI
Main Effects Model					
$R^2 = .072$, *MSE* = 146.225, $p < .001$					
Gender		-.603	.677	-.890	---
Income		.121	.672	.179	---
Poor Monitoring		3.300	.775	4.260**	---
SCL Reactivity		.160	.123	1.298	---
Poor Monitoring and Supervision Moderation Model					
$R^2 = .0798$, *MSE* = 27.5091, $p < .001$					
Intercept	i_1	8.2790	1.2484	6.6318**	[5.8213, 10.7367]
SCL Reactivity (X)	b_1	-.5708	.3897	-1.4648	[-1.3379, .1964]
Poor Monitoring (M)	b_2	2.1851	.8407	2.5993**	[.5301, 3.8401]
X × M	b_4	.5428	.2774	1.9559†	[-.0035, 1.0892]

†$p < .10$ *$p < .05$ **$p < .01$

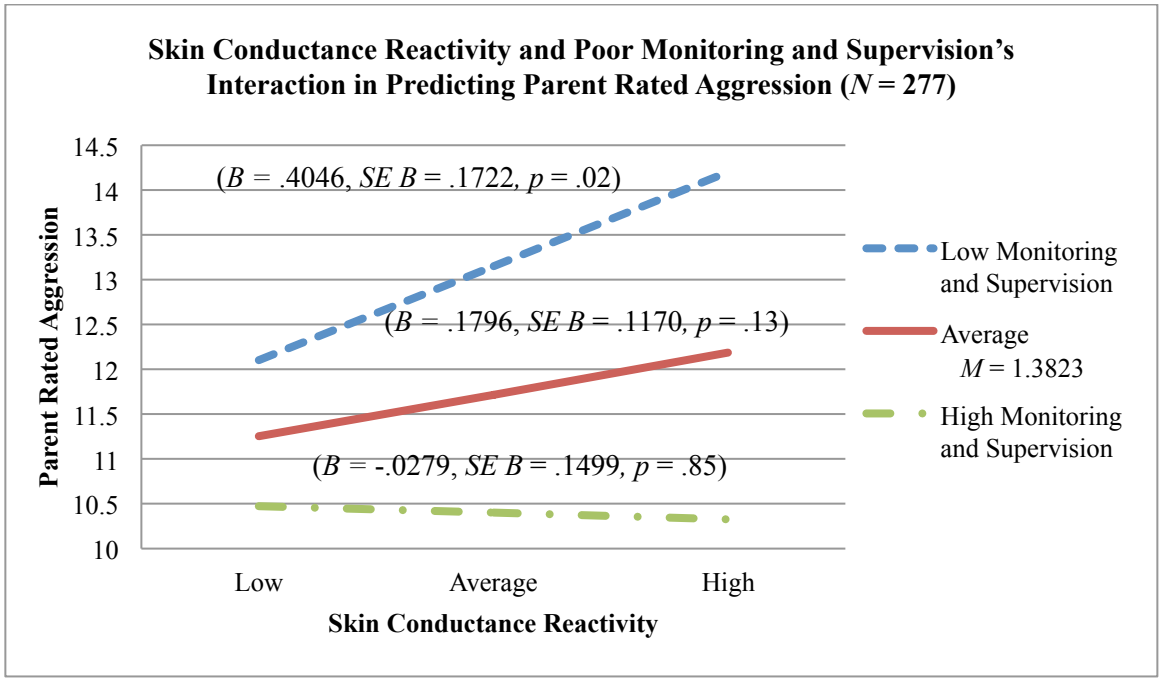

Figure 8: Skin Conductance Reactivity and Poor Monitoring and Supervision's Interaction in Predicting Parent Rated Aggression (*N* = 277)

Summary. Significant results from twelve moderated regression analyses were presented in this section. Of the twelve models, three models revealed non-significant interactions that trended towards significance. No significant interactions were found for models that included

RSA reactivity. A summary of results for the parent rated externalizing behavior subscales is shown in Table 17.

Table 17

Summary of Moderation Results for Higher Levels of Externalizing Behavior: Parent Subscales

	Parent Rated Conduct Problems	Parent Rated Hyperactivity	Parent Rated Aggression
Baseline SCL	High baseline SCL with high parental involvement†	---	---
Baseline RSA	---	Low baseline RSA with average† and low inconsistent discipline**	---
SCL Reactivity	---	---	High SCL reactivity with low monitoring and supervision*
RSA Reactivity	---	---	---

†slope *at* $p < .10$ *significant slope at $p < .05$ **significant slope at $p < .01$

Main Effects of Autonomic Arousal, Parenting, Gender, and Income on Teacher Rated Externalizing Behavior

The relationships between autonomic arousal, parenting practices, and teacher rated externalizing behavior was assessed using multiple regression analyses. Demographic variables (i.e., gender, income) were entered as control variables. Demographic variables were removed from the final moderated regression model if they did not significantly contribute to the variance in externalizing behavior. A summary of the twelve main effects models for teacher rated externalizing behavior is shown in Table 21.

Parental involvement. This subsection is divided into four parts. More specifically, this subsection presents four regression models that include parental involvement, autonomic arousal

(i.e., baseline SCL, baseline RSA, SCL reactivity, RSA reactivity), gender, and income as predictors of teacher rated externalizing behavior.

Baseline SCL and parental involvement. Regression analyses revealed that a model including gender, income, baseline SCL, and parental involvement did not significantly predicted teacher rated externalizing behavior ($F_{(4, 278)} = 2.186$, $R^2 = .030$, $p = .071$); regression results are shown in Table 18. Gender ($B = -6.217$, $SE\ B = 2.228$, $p = .006$) was a significant predictor in this model. This significant negative relationship indicated higher levels of teacher rated externalizing behavior are associated with the male gender.

Baseline RSA and parental involvement. Regression analyses revealed that a model including gender, income, baseline RSA, and parental involvement did not significantly predict teacher rated externalizing behavior ($F_{(4, 268)} = 2.010$, $R^2 = .029$, $p = .093$); regression results are shown in Table 18. Gender was a significant predictor in this model ($B = -5.794$, $SE\ B = 2.243$, $p = .01$). This significant negative relationship indicated higher levels of teacher rated externalizing behavior are associated with the male gender.

SCL reactivity and parental involvement. Regression analyses revealed that a model including gender, income, SCL reactivity, and parental involvement significantly predicted teacher rated externalizing behavior ($F_{(4, 267)} = 2.453$, $R^2 = .035$, $p = .046$); regression results are shown in Table 18. Gender ($B = -6.496$, $SE\ B = 2.246$, $p = .004$) was a significant predictor in this model. This significant negative relationship indicated higher levels of teacher rated externalizing behavior are associated with the male gender.

RSA reactivity and parental involvement. Regression analyses revealed that a model including gender, income, RSA reactivity, and parental involvement did not significantly predict teacher rated externalizing behavior ($F_{(4, 247)} = 2.015$, $R^2 = .032$, $p = .093$); regression results

are shown in Table 18. Gender (B = -6.405, $SE\ B$ = 2.379, p = .008) was a significant predictor in this model. This significant negative relationship indicated higher levels of teacher rated externalizing behavior are associated with the male gender.

Table 18

Regression Analysis Summary for Parental Involvement and Autonomic Arousal's Interaction in Predicting Teacher Rated Externalizing Behavior

		B	*SE B*	*t*
$F(4, 278) = 2.186$, $R^2 = .030$, $p = .071$				
	Gender	-6.217	2.228	-2.791**
	Income	-1.244	2.211	-.563
	P. Involvement	1.676	1.958	.856
	Baseline SCL	.120	.195	.615
$F(4, 268) = 2.010$, $R^2 = .029$, $p = .093$				
	Gender	-5.794	2.243	-2.583**
	Income	-.093	2.218	-.042
	P. Involvement	1.481	1.934	.766
	Baseline RSA	1.113	.929	1.197
$F(4, 267) = 2.453$, $R^2 = .035$, $p = .046$				
	Gender	-6.496	2.246	-2.891**
	Income	-1.176	2.219	-.530
	P. Involvement	1.407	2.010	.700
	SCL Reactivity	-.488	.406	-1.200
$F(4, 247) = 2.015$, $R^2 = .032$, $p = .093$				
	Gender	-6.405	2.379	-2.693**
	Income	-.651	2.352	-.277
	P. Involvement	1.845	2.098	.879
	RSA Reactivity	-1.104	1.549	-.713

$^{\dagger}p < .10$ $*p < .05$ $**p < .01$

Poor monitoring and supervision. This subsection is divided into four parts. More specifically, this subsection presents four regression models that include poor monitoring and supervision, autonomic arousal (i.e., baseline SCL, baseline RSA, SCL reactivity, RSA reactivity), gender, and income as predictors of teacher rated externalizing behavior.

Baseline SCL and poor monitoring and supervision. Regression analyses revealed that a

model including gender, income, baseline SCL, and poor monitoring and supervision did not significantly predict teacher rated externalizing behavior ($F(4, 278) = 2.357$, $R^2 = .033$, $p = .054$); regression results are shown in Table 19. Gender ($B = -5.932$, $SE\ B = 2.224$, $p = .008$) was a significant predictor in this model. This significant negative relationship indicated higher levels of teacher rated externalizing behavior were associated with the male gender.

Baseline RSA and poor monitoring and supervision. Regression analyses revealed that a model including gender, income, baseline RSA, and poor monitoring and supervision did not significantly predict teacher rated externalizing behavior ($F(4, 268) = 2.118$, $R^2 = .016$, $p = .079$); regression results are shown in Table 19. Gender ($B = -5.591$, $SE\ B = 2.240$, $p = .013$) was a significant predictor in this model. This significant negative relationship indicated higher levels of teacher rated externalizing behavior were associated with the male gender.

SCL reactivity and poor monitoring and supervision. Regression analyses revealed that a model including gender, income, SCL reactivity, and poor monitoring and supervision significantly predicted teacher rated externalizing behavior ($F(4, 267) = 2.775$, $R^2 = .040$, $p = .026$); regression results are shown in Table 19. Gender ($B = -6.222$, $SE\ B = 2.238$, $p = .006$) was a significant predictor in this model. This significant negative relationship indicated higher levels of teacher rated externalizing behavior were associated with the male gender.

RSA reactivity and poor monitoring and supervision. Regression analyses revealed that a model including gender, income, RSA reactivity, and poor monitoring and supervision did not significantly predict teacher rated externalizing behavior ($F(4, 247) = 1.951$, $R^2 = .031$, $p = .103$); regression results are shown in Table 19. Gender ($B = -6.116$, $SE\ B = 2.370$, $p = .010$) was a significant predictor in this model. This significant negative relationship indicated higher levels of teacher rated externalizing behavior were associated with the male gender.

Table 19

Regression Analysis Summary for Poor Monitoring and Supervision and Autonomic Arousal's Interaction in Predicting Teacher Rated Externalizing Behavior

	B	*SE B*	*t*
$F(4, 278) = 2.357$, $R^2 = .033$, $p = .054$			
Gender	-5.932	2.224	-2.667**
Income	-.837	2.220	-.377
Poor Monitoring	3.175	2.685	1.183
Baseline SCL	.113	.194	.580
$F(4, 268) = 2.118$, $R^2 = .016$, $p = .079$			
Gender	-5.591	2.240	-2.495**
Income	.313	2.246	.139
Poor Monitoring	2.838	2.833	1.002
Baseline RSA	1.137	.929	1.224
$F(4, 267) = 2.775$, $R^2 = .040$, $p = .026$			
Gender	-6.222	2.238	-2.780**
Income	-.800	2.227	-.359
Poor Monitoring	3.558	2.701	1.317
SCL Reactivity	-.468	.406	-1.153
$F(4, 247) = 1.951$, $R^2 = .031$, $p = .103$			
Gender	-6.116	2.370	-2.580**
Income	-.292	2.386	-.122
Poor Monitoring	2.151	2.974	.723
RSA Reactivity	-1.087	1.550	-.702

$^{\dagger}p < .10$ $*p < .05$ $**p < .01$

Inconsistent discipline. This subsection is divided into four parts. More specifically, this subsection presents four regression models that include inconsistent discipline, autonomic arousal (i.e., baseline SCL, baseline RSA, SCL reactivity, RSA reactivity), gender, and income as predictors of teacher rated externalizing behavior.

Baseline SCL and inconsistent discipline. Regression analyses revealed that a model including gender, income, baseline SCL, and inconsistent discipline did not significantly predict teacher rated externalizing behavior ($F(4, 278) = 1.999$, $R^2 = .028$, $p = .095$); regression results are shown in Table 20. Gender ($B = -6.095$, $SE\ B = 2.227$, $p = .007$) was a significant predictor

in this model. This significant negative relationship indicated that higher levels of teacher rated externalizing behavior were associated with the male gender.

Baseline RSA and inconsistent discipline. Regression analyses revealed that a model including gender, income, baseline RSA, and inconsistent discipline did not significantly predict teacher rated externalizing behavior ($F_{(4, 268)} = 1.867$, $R^2 = .027$, $p = .116$); regression results are shown in Table 20. Gender ($B = -5.699$, $SE\ B = 2.242$, $p = .012$) was a significant predictor in this model. This significant negative relationship indicated that higher levels of teacher rated externalizing behavior were associated with the male gender.

SCL reactivity and inconsistent discipline. Regression analyses revealed that a model including gender, income, SCL reactivity, and inconsistent discipline did not significantly predict teacher rated externalizing behavior ($F_{(4, 267)} = 2.331$, $R^2 = .034$, $p = .056$); regression results are shown in Table 20. Gender ($B = -6.390$, $SE\ B = 2.243$, $p = .005$) was a significant predictor in this model. This significant negative relationship indicated that higher levels of teacher rated externalizing behavior were associated with the male gender.

RSA reactivity and inconsistent discipline. Regression analyses revealed that a model including gender, income, RSA reactivity, and inconsistent discipline did not significantly predict teacher rated externalizing behavior ($F_{(4, 247)} = 1.853$, $R^2 = .029$, $p = .119$); regression results are shown in Table 20. Gender ($B = -6.208$, $SE\ B = 2.370$, $p = .009$) was a significant predictor in this model. This significant negative relationship indicated that higher levels of teacher rated externalizing behavior were associated with the male gender.

Table 20

Regression Analysis Summary for Inconsistent Discipline and Autonomic Arousal's Interaction in Predicting Teacher Rated Externalizing Behavior

	B	*SE B*	*t*
$F(4, 278) = 1.999$, $R^2 = .028$, $p = .095$			
Gender	-6.095	2.227	-2.737**
Income	-1.123	2.224	-.505
Inconsistent Discipline	.130	1.540	.085
Baseline SCL	.102	.195	.523
$F(4, 268) = 1.867$, $R^2 = .027$, $p = .116$			
Gender	-5.699	2.242	-2.542**
Income	-.012	2.233	-.005
Inconsistent Discipline	.277	1.599	.174
Baseline RSA	1.109	.930	1.192
$F(4, 267) = 2.331$, $R^2 = .034$, $p = .056$			
Gender	-6.390	2.243	-2.848**
Income	-1.094	2.232	-.490
Inconsistent Discipline	.216	1.531	.141
SCL Reactivity	-.492	.407	-1.209
$F(4, 247) = 1.853$ $R^2 = .029$, $p = .119$			
Gender	-6.208	2.370	-2.620**
Income	-.504	2.363	-.213
Inconsistent Discipline	.631	1.676	.376
RSA Reactivity	-1.051	1.551	-.678

$^{\dagger}p < .10$ $*p < .05$ $**p < .01$

Summary. Regression analyses revealed that gender is consistent significant predictor of teacher rated externalizing behavior. More specifically, overall, males are associated with higher levels of teacher rated externalizing behavior. A summary of the main effects of parenting, autonomic arousal, gender, and income on teacher rated externalizing behavior is shown in Table 21.

Table 21

Summary of Main Effects of Autonomic Arousal, Parenting, Gender, and Income on Teacher Rated Externalizing Behavior

	Parental Involvement	Poor Monitoring and Supervision	Inconsistent Discipline
Baseline SCL	Males: higher externalizing behavior for all**		
Baseline RSA	Males: higher externalizing behavior for all**		
SCL Reactivity	Males: higher externalizing behavior for all**		
RSA Reactivity	Males: higher externalizing behavior for all**		

†slope *at* $p < .10$ *significant slope at $p < .05$ **significant slope at $p < .01$

Moderation Analyses: Teacher Rated Externalizing Behavior

In the following analyses gender and yearly household income were entered as control variables unless they did not contribute significantly to the model, in which case they were removed to ensure better model fit. A summary of the results for the four moderation models for parental involvement is shown in Table 22, while the four moderation models for poor monitoring and supervision are shown in Table 20. The four moderation models for inconsistent discipline are shown in Table 24.

Table 22

Moderated Regression Analysis Summary for Parental Involvement and Autonomic Arousal's Interaction in Predicting Teacher Rated Externalizing Behavior

		B	*SE B*	*t*	95% CI
R^2 = .0295, *MSE* = 306.038, *p* = .07					
Intercept	i_1	39.5387	15.5230	2.5471*	[8.9812, 70.0963]
Baseline SCL (X)	b_1	-1.2028	1.1344	-1.0603	[-5.5037, 9.7604]
P. Involvement (M)	b_2	2.1284	3.8770	.5490	[-11.4346, -1.0544]
X × M	b_3	-.0663	.4383	-.1514	[-.9291, .7965]
R^2 = .0295, *MSE* = 306.1067, *p* = .056					
Intercept	i_1	18.1497	55.7201	.3257	[-91.5552, 127.8545]
Baseline RSA (X)	b_1	3.3099	7.2338	.4576	[-10.9324, 17.5523]
P. Involvement (M)	b_2	5.5284	13.5013	.4095	[-21.0537, 32.1104]
X × M	b_3	-.5481	1.7574	-.3119	[-4.0082, 2.9120]
R^2 = .0361, *MSE* = 302.2969, *p* = .043					
Intercept	i_1	50.7595	12.6394	4.0160**	[25.8739, 75.6452]
SCL Reactivity (X)	b_1	-2.7799	3.1829	-.8734	[-9.0466, 3.4869]
P. Involvement (M)	b_2	-.0658	3.0959	-.0212	[-6.1612, 6.0297]
X × M	b_3	.5776	.8016	.7205	[-1.0007, 2.1559]
R^2 = .0325, *MSE* = 316.6871, *p* = .073					
Intercept	i_1	41.6855	8.5426	4.8797**	[24.8599, 58.5111]
RSA Reactivity (X)	b_1	5.9569	13.5477	.4397	[-20.7267, 32.6406]
P. Involvement (M)	b_2	2.0264	2.1295	.9516	[-2.1678, 6.2206]
X × M	b_3	-1.7415	3.2744	-.5319	[-8.1908, 4.7077]

†$p < .10$ *$p < .05$ **$p < .01$

Table 23

Moderated Regression Analysis Summary for Poor Monitoring and Supervision and Autonomic Arousal's Interaction in Predicting Teacher Rated Externalizing Behavior

		B	*SE B*	*t*	95% CI
$R^2 = .0390$, $MSE = 303.039$, $p = .017$					
Intercept	i_1	36.2331	7.5073	4.8264**	[21.4546, 51.0115]
Baseline SCL (X)	b_1	.9852	.7429	1.3262	[-.4772, 2.4476]
P. Monitoring (M)	b_2	8.2064	4.6037	1.7826†	[-.8562, 17.2689]
X × M	b_3	-.6503	.5264	-1.2354	[-1.6865, .3859]
$R^2 = .0309$, $MSE = 305.649$, $p = .029$					
Intercept	i_1	29.4908	23.7894	1.2397	[-17.3471, 76.3287]
Baseline RSA (X)	b_1	2.0388	3.0659	.6650	[-3.9974, 8.0751]
P. Monitoring (M)	b_2	7.5182	16.4721	.4564	[-24.9131, 39.9495]
X × M	b_3	-.6530	2.1489	-.3039	[-4.8840, 3.5779]
$R^2 = .0395$, $MSE = 301.2435$, $p = .0188$					
Intercept	i_1	45.1889	5.9423	7.6046**	[33.4891, 56.8886]
SCL Reactivity (X)	b_1	-.5285	1.3566	.3907	[-3.1995, 2.1426]
P. Monitoring (M)	b_2	3.5712	3.2610	1.0940	[-3.1995, 2.1426]
X × M	b_3	.0459	.9268	-.0485	[-1.7787, 1.8706]
$R^2 = .0342$, $MSE = 316.107$, $p = .0443$					
Intercept	i_1	46.4329	5.4389	8.5373**	[35.7205, 57.1454]
RSA Reactivity (X)	b_1	-6.8388	7.4392	-.9193	[-21.4911, 7.8136]
P. Monitoring (M)	b_2	1.8852	2.8006	.6731	[-3.6309, 7.4013]
X × M	b_3	4.2945	5.7606	.7455	[-7.0517, 15.6406]

†$p < .10$ *$p < .05$ **$p < .01$

Table 24

Moderated Regression Analysis Summary for Inconsistent Discipline and Autonomic Arousal's Interaction in Predicting Teacher Rated Externalizing Behavior

		B	*SE B*	*t*	95% CI
$R^2 = 0272$, *MSE* = 306.761, *p* = .07					
Intercept	i_1	48.3553	8.4174	5.7447	[31.7853, 64.9253]
Baseline SCL (X)	b_1	-.0371	.8124	-.0457	[-1.6364, 1.5622]
Inconsistent Discipline (M)	b_2	-.2037	3.2344	-.0630	[-6.5708, 6.1631]
X × M	b_3	.0511	.3242	.1577	[-.5871, .6893]
$R^2 = .0370$, *MSE* = 303.734, *p* = .028					
Intercept	i_1	80.2278	26.6949	3.0054**	[27.6695, 132.7861]
Baseline RSA (X)	b_1	-4.2691	3.4854	-1.2249	[-11.1313, 2.5931]
Inconsistent Discipline (M)	b_2	-16.7445	11.0511	-1.5152	[-38.5026, 5.0135]
X × M	b_3	2.2694	1.4787	1.5347	[-.6420, 5.1808]
$R^2 = .0378$, *MSE* = 301.779, *p* = .024					
Intercept	i_1	53.3846	6.2381	8.5579**	[41.1025, 65.6666]
SCL Reactivity (X)	b_1	-2.0920	1.4784	-1.4151	[-5.0028, .8187]
Inconsistent Discipline (M)	b_2	-1.3381	2.1777	-.6145	[-5.6257, 2.9494]
X × M	b_3	.6666	.6239	1.0685	[-.5618, 1.8950]
$R^2 = .0331$, *MSE* = 316.489, *p* = .047					
Intercept	i_1	46.3497	5.6575	8.5461**	[37.2065, 59.4928]
RSA Reactivity (X)	b_1	-7.5736	5.9039	-1.2828	[-19.2020, 4.0548]
Inconsistent Discipline (M)	b_2	.3978	1.7663	.2252	[-3.0812, 3.8768]
X × M	b_3	2.9255	2.2362	1.0917	[-2.3524, 8.2033]

$^{\dagger}p < .10$ *$p < .05$ **$p < .01$

Summary. Twelve moderated regression analyses were examined in this section. Parenting practices were examined as moderators of the relationships between autonomic arousal and teacher rated externalizing behavior. None of the interaction effects between autonomic arousal and each of the three parenting practices produced significant outcomes.

Moderation Analyses for Externalizing Subscales: Teacher Rated Aggression, Hyperactivity, and Conduct Problems

The outcome variable examined in the primary analyses was conducted with a composite score, which was comprised of three scales (i.e., aggression, hyperactivity, conduct problems).

Although no interaction effects were found between autonomic arousal and three parenting practices as predictors of teacher reported externalizing behavior, a significant interaction was found when examining the scales individually. Bivariate correlations, means, standard deviations, *n*s, skewness, and kurtosis for study variables including the three BASC scales (i.e., aggression, hyperactivity, conduct problems) are presented in Table 13. Correlations revealed that teacher rated aggression was positively associated with both parent rated conduct problems (r = .689, p < .01) and teacher rated hyperactivity (r = .708, p < .01). In addition, teacher rated hyperactivity was moderately associated with teacher rated conduct problems (r = .526, p < .05). This indicated these teacher rated scales were correlated, but with some for variability within and between scales.

Teacher rated hyperactivity. Regression analyses revealed that a model including gender, income, baseline RSA, and inconsistent discipline significantly predicted teacher rated hyperactivity ($F(4, 268)$ = 2.856, R^2 = .041, p = .024); the regression results are shown in Table 15. Gender (B = -3.385, $SE\ B$ = 1.019, p = .001) was a significant predictor in this model. This demonstrated a significant negative relationship between gender and teacher rated hyperactivity, indicating that higher levels of teacher rated hyperactivity were associated with the male gender.

When inconsistent discipline was examined as a moderator in the relationship between baseline RSA and teacher rated hyperactivity and gender was controlled for, the interaction was significant (B = 1.5457, SE = .6230, p = .0137, 95% CI = .3191, 2.7723); regression results are shown in Table 25. The overall model accounted for 6% of the total variance of teacher rated hyperactivity ($F(4, 268)$ = 4.6680, p = .0012). The Johnson-Neyman technique (Hayes, 2013) used for determining regions of significance indicated significant conditional effects of inconsistent discipline at levels above 2.8368 ($t(268)$ = 1.9689, p = .05, B = -.9916). A plot of the

interaction indicated that baseline RSA was positively associated with teacher rated hyperactivity in the presence of high inconsistent discipline, but negatively associated with teacher rated hyperactivity in the presence of low levels of inconsistent discipline (Figure 9). Overall, the level of inconsistent discipline was influential on children's teacher rated hyperactivity for children with low and high baseline RSA. For children with low baseline RSA, low inconsistent discipline was related to high levels of teacher rated hyperactivity compared to children exposed to high inconsistent discipline which was related to low levels of teacher rated hyperactivity. However, these relationships were reversed in children with high baseline RSA. For example, for children with high baseline RSA, low inconsistent discipline was related to low levels of teacher rated hyperactivity.

Table 25

Regression Analysis Summary for Baseline Respiratory Sinus Arrhythmia and Inconsistent Discipline's Interaction in Predicting Teacher Rated Hyperactivity (N = 273)

Variable		*B*	*SE B*	*t*	95% CI
Main Effects Model					
$R^2 = .041$, *MSE* = 180.96, *p* = .025					
Gender		-3.385	1.019	-3.322**	---
Income		.152	1.015	.150	---
Inconsistent Discipline		.173	.726	.238	---
Baseline RSA		.273	.423	.645	---
Inconsistent Discipline Moderation Model					
$R^2 = .0626$, *MSE* = 61.928, *p* = .0012					
Intercept	i_1	47.6599	11.8277	4.0295**	[24.3728, 70.9469]
Baseline RSA (X)	b_1	-3.3932	1.5258	-2.2240*	[-6.3973, -.3892]
Inconsistent Discipline (M)	b_2	-11.4331	4.6977	-2.4338*	[-20.6821, -2.1841]
X × M	b_4	1.5457	.6230	2.4810*	[.3191, 2.7723]

$^{\dagger}p < .10$ *$p < .05$ **$p < .01$

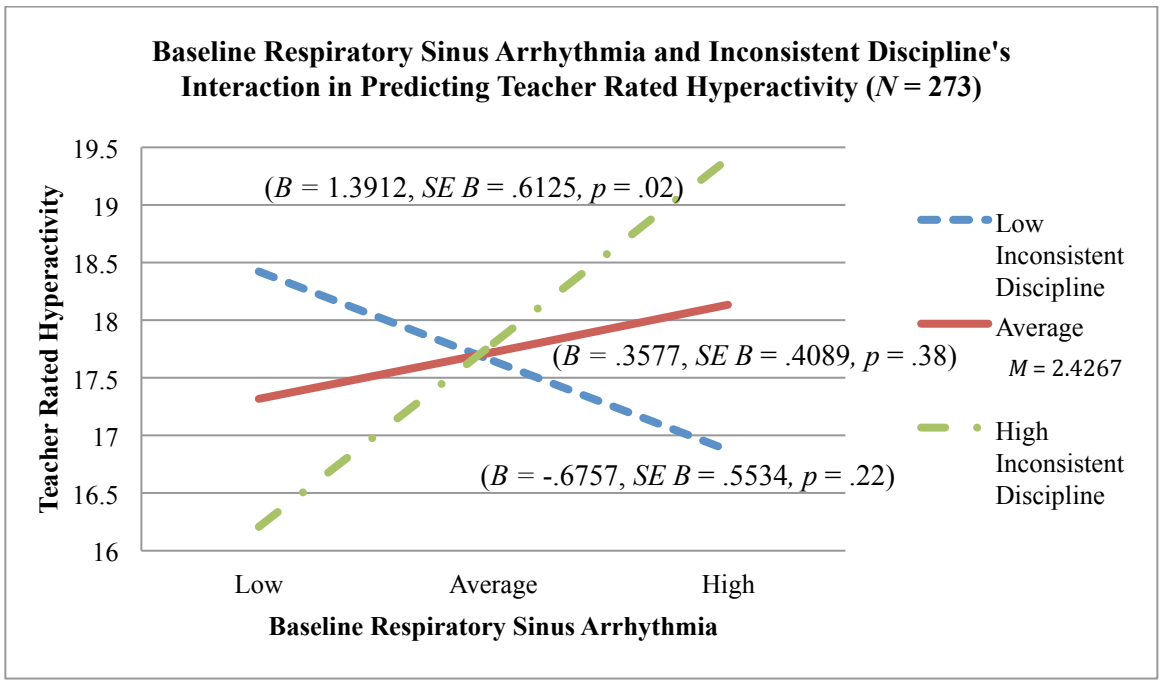

Figure 9: Baseline Respiratory Sinus Arrhythmia and Inconsistent Discipline's Interaction in Predicting Teacher Rated Hyperactivity ($N = 273$)

Summary. Of the twelve moderated regression analyses examined in this section, one significant interaction was found. A summary of results examining teacher rated externalizing behavior subscales is shown in Table 26.

Table 26

Summary of Moderation Results for Higher Levels of Externalizing Behavior: Teacher Subscales

	Teacher Rated Conduct Problems	Teacher Rated Hyperactivity	Teacher Rated Aggression
Baseline SCL	---	---	---
Baseline RSA	---	High baseline RSA with high inconsistent discipline*	---
SCL Reactivity	---	---	---
RSA Reactivity	---	---	---

†slope *at* $p < .10$ *significant slope at $p < .05$ **significant slope at $p < .01$

Secondary Analyses

Two sets of secondary analyses were conducted. The first set addressed the relationship between parenting practices, baseline SCL/RSA, and gender to predict externalizing behaviors in children. The second set of analyses examined the relationship between parenting practices, baseline SCL/RSA, and yearly household income to predict externalizing behaviors in children. A summary of the results for the twelve double moderation models for parent rated externalizing behavior is shown in Table 33. The twelve double moderation models for teacher rated externalizing behavior are shown in Table 34.

Double Moderation Analyses: Gender

In the following analyses gender was entered as a second moderator. A summary of the results for the four double moderation models for parental involvement is shown in Table 27, and

the four double moderation models for poor monitoring and supervision are shown in Table 28. The four double moderation models for inconsistent discipline are shown in Table 29.

Parental Involvement. None of the two or three way interaction effects between autonomic arousal, gender, and parental involvement produced significant outcomes. However, regression analyses revealed that a model including gender, parental involvement, baseline RSA, and teacher rated externalizing behavior exhibited a non-significant trend (B = -7.7494, $SE\ B$ = 4.1860, p = .0652). A summary of the results for the four moderation models for parental involvement is shown in Table 27. A plot for parental involvement for males indicated that baseline RSA was positively associated with teacher rated externalizing behavior regardless of the level of parental involvement (Figure 10). For females, baseline RSA and teacher rated externalizing behavior was negatively associated with high parental involvement, but there was a positive relationship in the presence of low parental involvement (Figure 11).

Table 27

Double Moderated Regression Analysis Summary for Parental Involvement, Gender, and Autonomic Arousal's Interaction in Predicting Externalizing Behavior

		B	*SE B*	*t*	95% CI
Parent Rated Externalizing Behavior					
$R^2 = .05$, *MSE* = 172.477, $p = .043$					
Intercept	i_1	28.9149	.7877	36.7057**	[27.3642, 30.4655]
Baseline SCL (X)	b_1	.1374	.1487	.9242	[-.1552, .4300]
P. Involvement (M)	b_2	-3.9345	1.4989	-2.6250**	[-6.8849, -.9840]
Gender (W)	b_3	-2.9526	1.6851	-1.7522†	[-6.2696, .3645]
X × M	b_4	.3455	.2933	1.1778	[-.2319, .9229]
X × W	b_5	-.0805	.3354	-.2401	[-.7407, .5797]
M × W	b_6	-2.4592	3.3469	-.7348	[-9.0475, 4.1292]
X × M × W	b_7	.1384	.6547	.2114	[-1.1504, 1.4273]
$R^2 = .0597$, *MSE* = 174.8834, $p = .019$					
Intercept	i_1	28.9306	.7980	36.2521**	[27.3594, 30.5018]
Baseline RSA (X)	b_1	-.9375	.7113	-1.3181	[-2.3378, .4628]
P. Involvement (M)	b_2	-3.6526	1.4713	-2.4825*	[-6.5493, -.7558]
Gender (W)	b_3	-3.1587	1.6792	-1.8811†	[-6.4647, .1473]
X × M	b_4	-1.7993	1.4122	-1.2741	[-4.5797, .9810]
X × W	b_5	1.5534	1.5505	1.0019	[-1.4992, 4.6060]
M × W	b_6	-1.4114	3.1570	-.4471	[-7.6269, 4.8041]
X × M × W	b_7	-4.0968	3.1547	-1.2986	[-10.3078, 2.1141]
Teacher Rated Externalizing Behavior					
$R^2 = .0349$, *MSE* = 307.6568, $p = .197$					
Intercept	i_1	40.6782	1.0606	38.3527**	[38.5902, 42.7662]
Baseline SCL (X)	b_1	.1495	.1997	.7487	[-.2436, .5427]
P. Involvement (M)	b_2	2.0723	2.0102	1.0309	[-1.8850, 6.0295]
Gender (W)	b_3	-5.7419	2.2629	-2.5374*	[-10.1968, -1.2871]
X × M	b_4	-.0435	.3933	-.1105	[-.8178, .7309]
X × W	b_5	.4988	.4502	1.1080	[-.3874, 1.3851]
M × W	b_6	2.0704	4.4805	.4621	[-6.7500, 10.9808]
X × M × W	b_7	.4436	.8778	.5053	[-1.2845, 2.1716]
$R^2 = .0454$, *MSE* = 304.4989, $p = .0877$					
Intercept	i_1	40.7504	1.0629	38.3378**	[38.6575, 42.8432]
Baseline RSA (X)	b_1	1.2475	.9454	1.3196	[-.6139, 3.1090]
P. Involvement (M)	b_2	1.9042	1.9522	.9754	[-1.9396, 5.7479]
Gender (W)	b_3	-5.8094	2.2326	-2.6020**	[-10.2054, -1.4134]
X × M	b_4	-1.2101	1.8738	-.6458	[-4.8995, 2.4792]
X × W	b_5	-1.1189	2.0628	-.5424	[-5.1805, 2.9427]
M × W	b_6	1.4766	4.1838	.3529	[-6.7611, 9.7143]
X × M × W	b_7	-7.7494	4.1860	-1.8513†	[-15.9914, .4926]

$^{\dagger}p < .10$ *$p < .05$ **$p < .01$

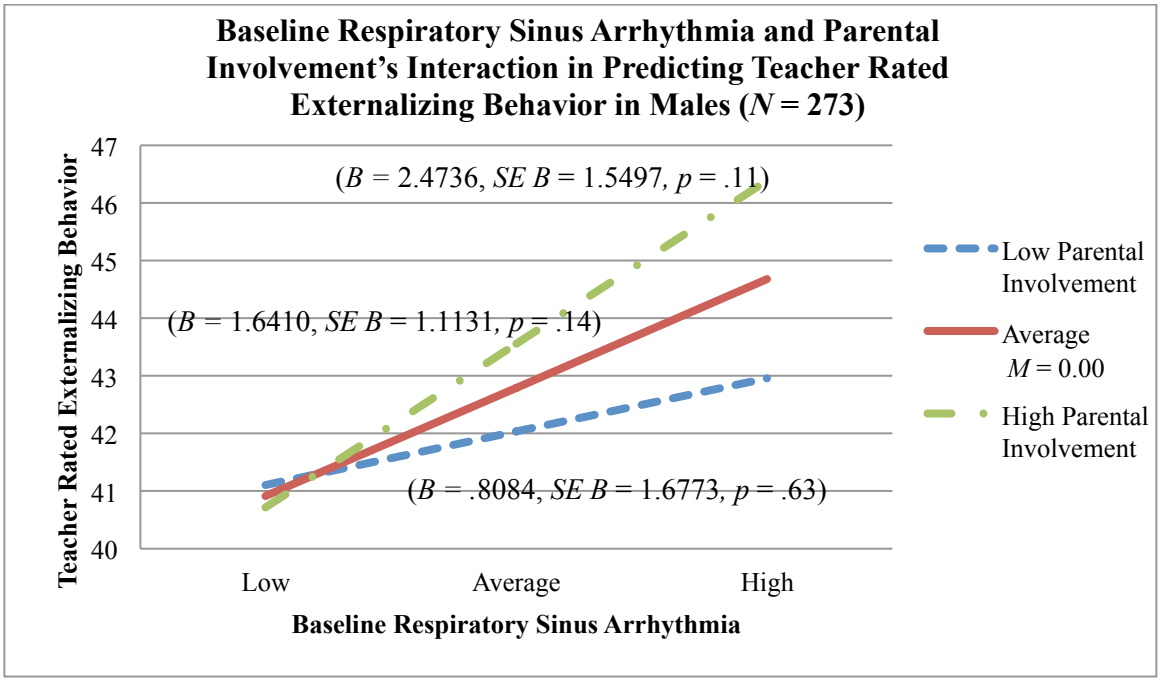

Figure 10: Baseline Respiratory Sinus Arrhythmia and Parental Involvement's Interaction in Predicting Teacher Rated Externalizing Behavior in Males ($N = 273$)

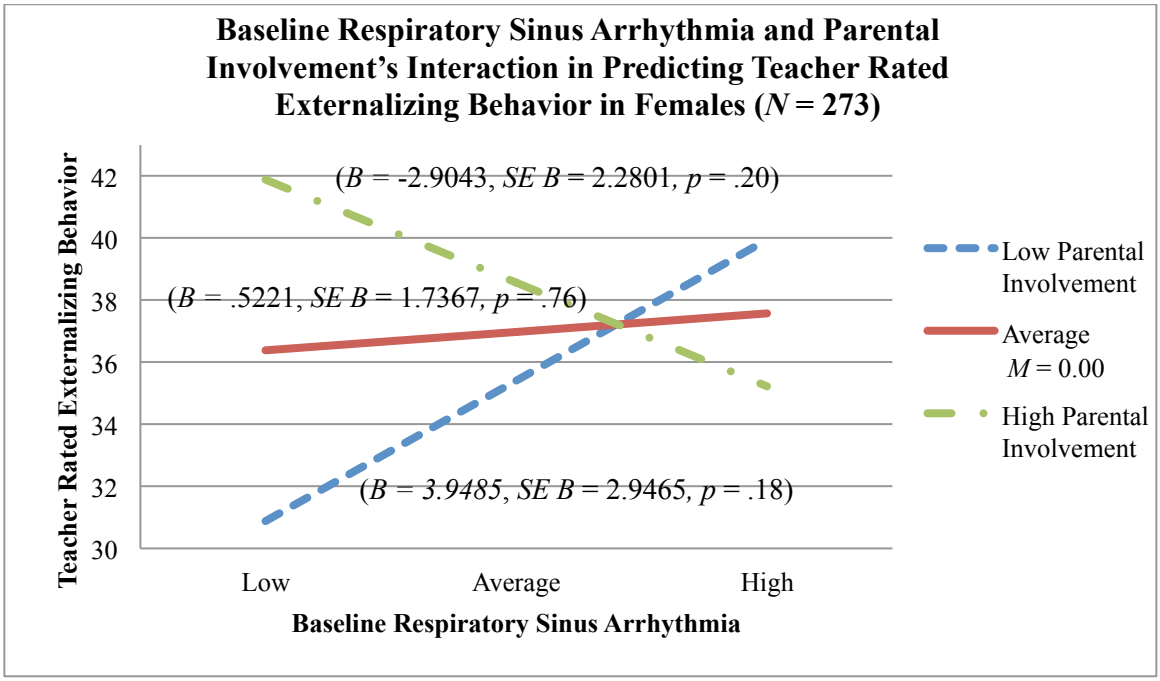

Figure 11: Baseline Respiratory Sinus Arrhythmia and Parental Involvement's Interaction in Predicting Teacher Rated Externalizing Behavior in Females ($N = 273$)

Poor Monitoring and Supervision. None of the two or three way interaction effects between autonomic arousal, gender, and poor monitoring produced significant outcomes.

However, regression analyses revealed that a model including gender, poor monitoring and supervision, and teacher rated externalizing behavior exhibited a non-significant trend (B = 11.4345, $SE\ B$ = 5.9658, p = .0652). A plot for poor monitoring and supervision for males indicated that baseline SCL was negatively associated with teacher rated externalizing behavior in the presence of low monitoring and supervision, but positively associated with teacher rated externalizing behavior in the presence of high monitoring and supervision (Figure 12). For females, baseline SCL was positively associated with teacher rated externalizing behavior regardless of the level of monitoring and supervision (Figure 13).

Further, a model including gender, poor monitoring and supervision, and teacher rated externalizing behavior exhibited a non-significant trend (B = 10.4690, $SE\ B$ = 6.1708, p = .091). A plot for poor monitoring and supervision for males indicated that baseline RSA was positively associated with teacher rated externalizing behavior regardless of the level of monitoring and supervision (Figure 14). For females, baseline RSA was negatively associated with teacher rated externalizing behavior in the presence of low monitoring and supervision, but positively associated with teacher rated externalizing behavior in the presence of high monitoring and supervision (Figure 15). A summary of the results for the four moderation models for poor monitoring and supervision is shown in Table 28.

Table 28

Double Moderated Regression Analysis Summary for Poor Monitoring and Supervision, Gender, and Autonomic Arousal's Interaction in Predicting Externalizing Behavior

		B	*SE B*	*t*	95% CI
Parent Rated Externalizing Behavior					
R^2 = .1020, *MSE* = 163.038, *p* = .0001					
Intercept	i_1	28.7869	.7588	37.9360**	[27.2932, 30.2806]
Baseline SCL (X)	b_1	.2279	.1426	1.5986	[-.0527, .5086]
P. Monitoring (M)	b_2	8.6262	1.8882	4.5684**	[4.9093, 12.3431]
Gender (W)	b_3	-2.9404	1.6056	-1.8314†	[-6.1010, .2201]
X × M	b_4	-.5230	.3528	-1.4825	[-1.2175, .1715]
X × W	b_5	.0595	.3180	.1870	[-.5665, .6854]
M × W	b_6	1.5455	4.2954	.3598	[-6.9100, 10.0009]
X × M × W	b_7	-1.1084	.8257	-1.3424	[-2.7337, .5170]
R^2 = .1007, *MSE* = 167.257, *p* = .0002					
Intercept	i_1	29.0052	.7808	37.1467**	[27.4679, 30.5425]
Baseline RSA (X)	b_1	-.8806	.6971	-1.2632	[-2.2531, .4919]
P. Monitoring (M)	b_2	8.9613	1.9889	4.5057**	[5.0456, 12.8771]
Gender (W)	b_3	-2.7997	1.6439	-1.7031†	[-6.0362, .4368]
X × M	b_4	1.0697	2.0198	.5296	[-2.9069, 5.0463]
X × W	b_5	1.5822	1.5196	1.0411	[-1.4097, 4.5740]
M × W	b_6	1.9898	4.4449	.4476	[-6.7613, 10.7408]
X × M × W	b_7	6.7238	5.2069	1.2913	[-3.5276, 16.9751]
Teacher Rated Externalizing Behavior					
R^2 = .0552, *MSE* = 301.1681, *p* = .03					
Intercept	i_1	40.6734	1.0382	39.1762**	[38.6295, 42.7172]
Baseline SCL (X)	b_1	.1182	.1951	.6058	[-.2659, .5023]
P. Monitoring (M)	b_2	4.2299	2.6891	1.5730	[-1.0639, 9.5237]
Gender (W)	b_3	-5.4055	2.1921	-2.4659*	[-9.7209, -1.0900]
X × M	b_4	-.6065	.4884	-1.2419	[-1.5679, .3549]
X × W	b_5	.4564	.4357	1.0476	[-.4013, 1.3142]
M × W	b_6	11.4345	5.9658	1.9167†	[-.3100, 23.1790]
X × M × W	b_7	.2444	1.1318	.2159	[-1.9838, 2.4725]
R^2 = .0471, *MSE* = 303.9382, *p* = .07					
Intercept	i_1	40.8185	1.0619	38.4384**	[38.7276, 42.9093]
Baseline RSA (X)	b_1	1.0349	.9430	1.0975	[-.8218, 8.5925]
P. Monitoring (M)	b_2	2.9928	2.8440	1.0523	[-2.6070, 42.9093]
Gender (W)	b_3	-5.5305	2.2315	-2.4784*	[-9.9242, -1.1367]
X × M	b_4	-2.1034	2.7712	-.7590	[-7.5597, 3.3529]
X × W	b_5	-1.9814	2.0514	-.9659	[-6.0205, 2.0577]
M × W	b_6	10.4690	6.1708	1.6965†	[-1.6810, 22.6189]
X × M × W	b_7	-4.0381	7.0644	-.5716	[17.9476, 9.8714]

†$p < .10$ *$p < .05$ **$p < .01$

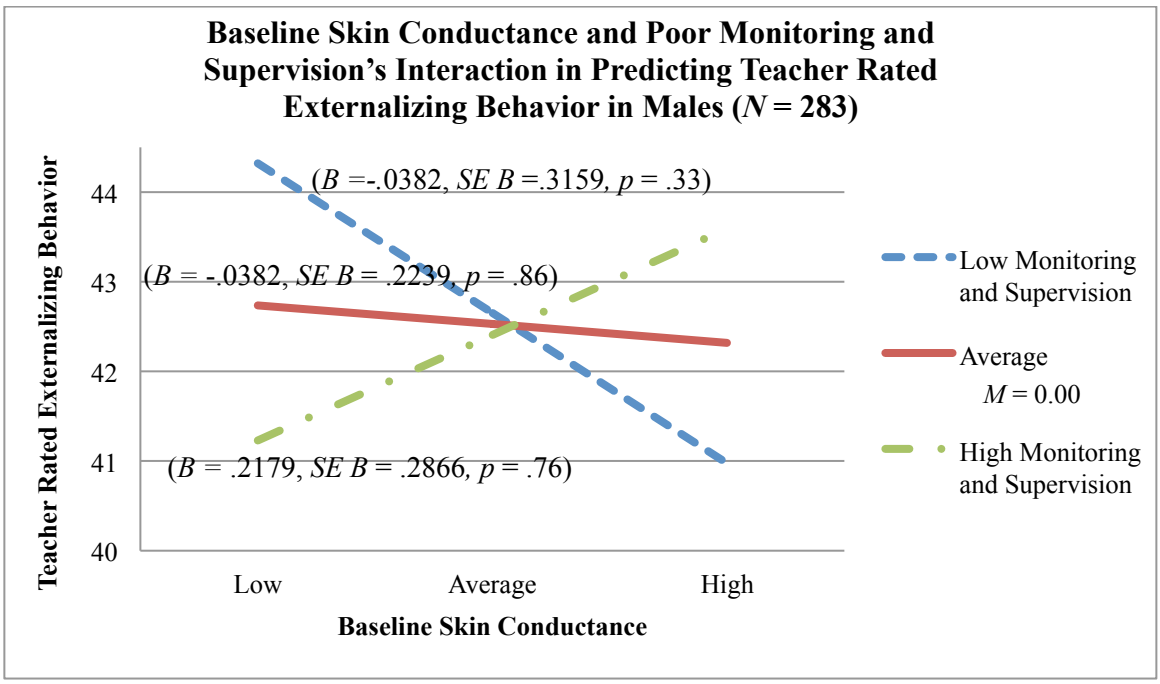

Figure 12: Baseline Skin Conductance and Poor Monitoring and Supervision's Interaction in Predicting Teacher Rated Externalizing Behavior in Males ($N = 283$)

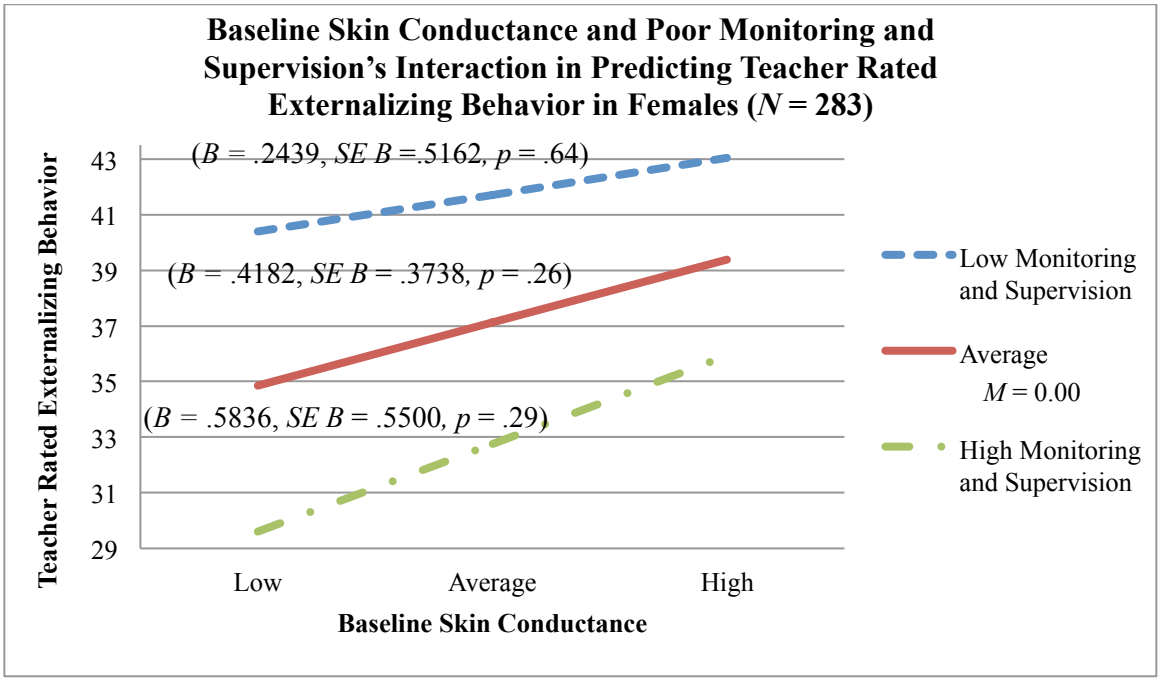

Figure 13: Baseline Skin Conductance and Poor Monitoring and Supervision's Interaction in Predicting Teacher Rated Externalizing Behavior in Females ($N = 283$)

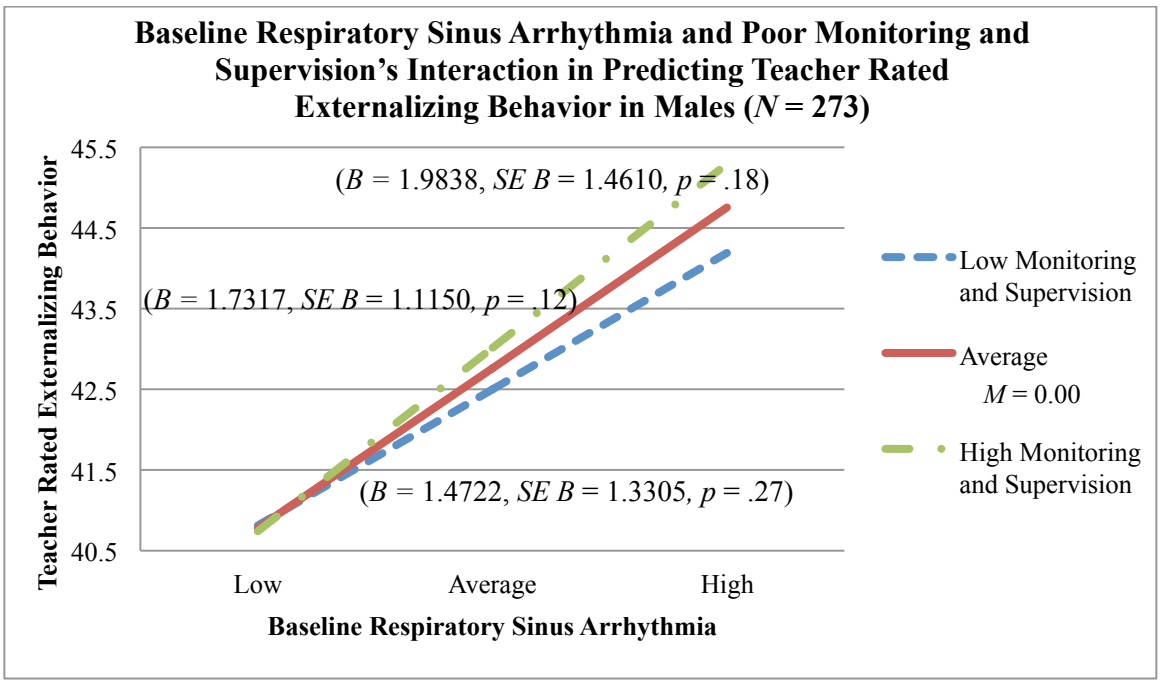

Figure 14: Baseline Respiratory Sinus Arrhythmia and Poor Monitoring and Supervision's Interaction in Predicting Teacher Rated Externalizing Behavior in Males ($N = 273$)

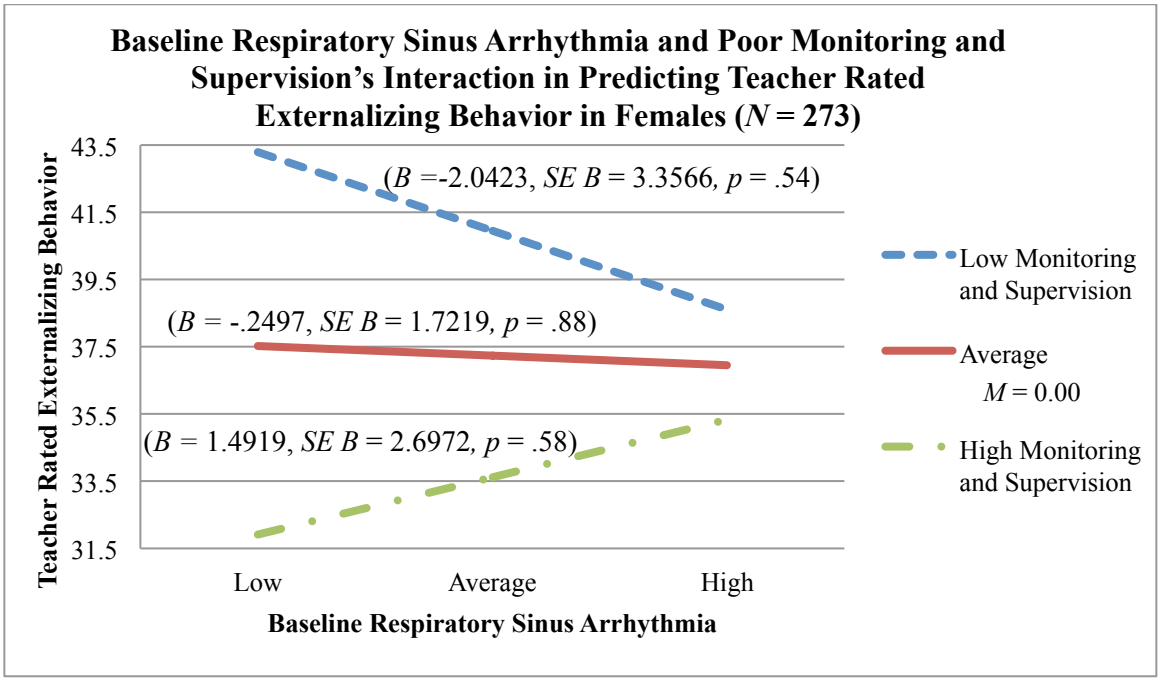

Figure 15: Baseline Respiratory Sinus Arrhythmia and Poor Monitoring and Supervision's Interaction in Predicting Teacher Rated Externalizing Behavior in Females ($N = 273$)

Inconsistent Discipline. None of the two or three way interaction effects between autonomic arousal, gender, and each of the three parenting practices produced significant

outcomes, though four non-significant trends were found. First, regression analyses revealed that a model including gender, inconsistent discipline, and parent rated externalizing behavior exhibited a non-significant trend (B = 4.1192, $SE\ B$ = 2.2206, p = .0647). A plot for inconsistent discipline for males indicated that baseline SCL was positively associated with parent rated externalizing behavior in the presence of high inconsistent discipline, but negatively associated with parent rated externalizing behavior in the presence of low inconsistent discipline (Figure 16). For females, baseline SCL was positively associated with teacher rated externalizing behavior regardless of the level of inconsistent discipline (Figure 17).

A two-way interaction between inconsistent discipline and gender in predicting parent rated externalizing behavior exhibited a non-significant trend (B = 3.9441, $SE\ B$ = 2.3083, p = .0887) and a three-way interaction between inconsistent discipline, gender, and baseline RSA exhibited a non-significant trend (B = 3.5279, $SE\ B$ = 2.0659, p = .0888). A plot for inconsistent discipline for males indicated that baseline RSA was negatively associated with parent rated externalizing behavior regardless of the level of inconsistent discipline (Figure 18). For females, baseline RSA was negatively associated with parent rated externalizing behavior in the presence of low inconsistent discipline, but positively associated with parent rated externalizing behavior in the presence of high inconsistent discipline (Figure 19).

Last, regression analyses revealed that a model including gender, inconsistent discipline, and teacher rated externalizing behavior exhibited a non-significant trend (B = 6.0977, $SE\ B$ = 3.2290, p = .0601). A plot for inconsistent discipline for males indicated that baseline RSA was positively associated with teacher rated externalizing behavior regardless of the level of inconsistent discipline (Figure 20). For females, baseline RSA was negatively associated with teacher rated externalizing behavior in the presence of low inconsistent discipline, but positively

associated with teacher rated externalizing behavior in the presence of high inconsistent discipline (Figure 21). A summary of the results for the four moderation models for inconsistent discipline is shown in Table 29.

Table 29

Double Moderated Regression Analysis Summary for Inconsistent Discipline, Gender, and Autonomic Arousal's Interaction in Predicting Externalizing Behavior

		B	*SE B*	*t*	95% CI
Parent Rated Externalizing Behavior					
$R^2 = .1413$, $MSE = 155.912$, $p < .001$					
Intercept	i_1	28.6838	.7418	38.6659**	[27.2235, 30.1441]
Baseline SCL (X)	b_1	.1230	.1400	.8784	[-.1526, .3986]
Inconsistent Discipline (M)	b_2	5.9323	1.0915	5.4348**	[3.7836, 8.0809]
Gender (W)	b_3	-3.8378	1.5684	-2.4470*	[-6.9251, -.7505]
X × M	b_4	.1974	.1921	1.0275	[-.1808, .5756]
X × W	b_5	.0203	.3139	.0647	[-.5977, .6383]
M × W	b_6	4.1192	2.2206	1.8550†	[-.2520, 8.4904]
X × M × W	b_7	-.0432	.3798	-.1137	[-.7908, .7044]
$R^2 = .1499$, $MSE = 158.1036$, $p < .001$					
Intercept	i_1	28.8561	.7610	37.9200**	[27.3579, 30.3543]
Baseline RSA (X)	b_1	-.8734	.6799	-1.2847	[-2.2119, .4651]
Inconsistent Discipline (M)	b_2	6.0860	1.1270	5.4001**	[3.8672, 8.3049]
Gender (W)	b_3	-3.6455	1.6008	-2.2772*	[-6.7972, -.4938]
X × M	b_4	1.0662	.9928	1.0739	[-.8884, 3.0207]
X × W	b_5	1.0094	1.4864	.6791	[-1.9170, 3.9357]
M × W	b_6	3.9441	2.3083	1.7087†	[-.6004, 8.4886]
X × M × W	b_7	3.5279	2.0659	1.7077†	[-.5394, 7.5952]
Teacher Rated Externalizing Behavior					
$R^2 = .041$, $MSE = 305.792$, $p = .1168$					
Intercept	i_1	40.5823	1.0496	38.6638**	[38.5160, 42.6486]
Baseline SCL (X)	b_1	.1145	.1979	.5785	[-.2751, .5040]
Inconsistent Discipline (M)	b_2	.0040	1.5709	.0026	[-3.0885, 3.0965]
Gender (W)	b_3	-5.9315	2.2136	-2.6796**	[-10.2892, -1.5738]
X × M	b_4	.0299	.2757	.1086	[-.5127, .5726]
X × W	b_5	.3289	.4435	.7415	[-.5442, 1.2020]
M × W	b_6	4.9962	3.1669	1.5776	[-1.2382, 11.2306]
X × M × W	b_7	.2846	.5419	.5252	[-.7822, 1.3514]
$R^2 = .0566$, $MSE = 300.916$, $p = .029$					
Intercept	i_1	40.7013	1.0590	38.4355**	[38.6162, 42.7863]
Baseline RSA (X)	b_1	1.1715	.9434	1.2418	[-.6860, 3.0290]
Inconsistent Discipline (M)	b_2	-.0285	1.5863	-.0180	[-3.1520, 3.0949]
Gender (W)	b_3	-5.9403	2.2240	-2.6710**	[-10.3193, -1.5613]
X × M	b_4	2.0110	1.3796	1.4577	[-.7054, 4.7273]
X × W	b_5	-1.2075	2.0639	-.5851	[-5.2712, 2.8562]
M × W	b_6	6.0977	3.2290	1.8884†	[-.2601, 12.4554]
X × M × W	b_7	3.0940	2.8700	1.0781	[-2.5569, 8.7448]

†$p < .10$ *$p < .05$ **$p < .01$

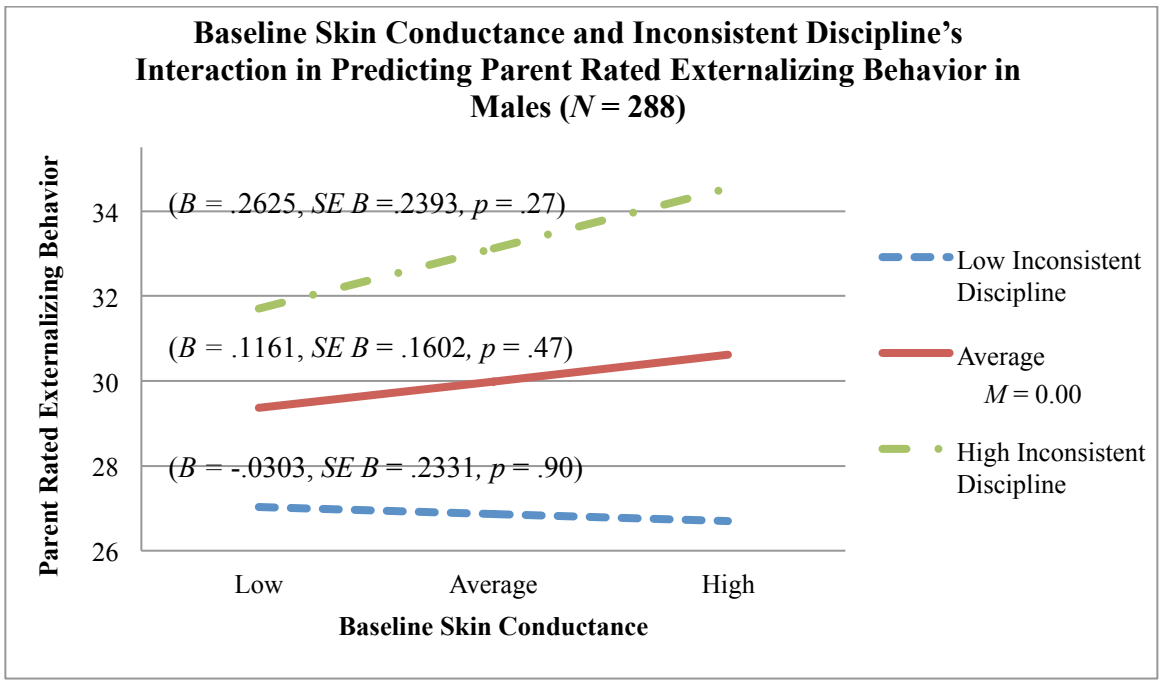

Figure 16: Baseline Skin Conductance and Inconsistent Discipline's Interaction in Predicting Parent Rated Externalizing Behavior in Males ($N = 288$)

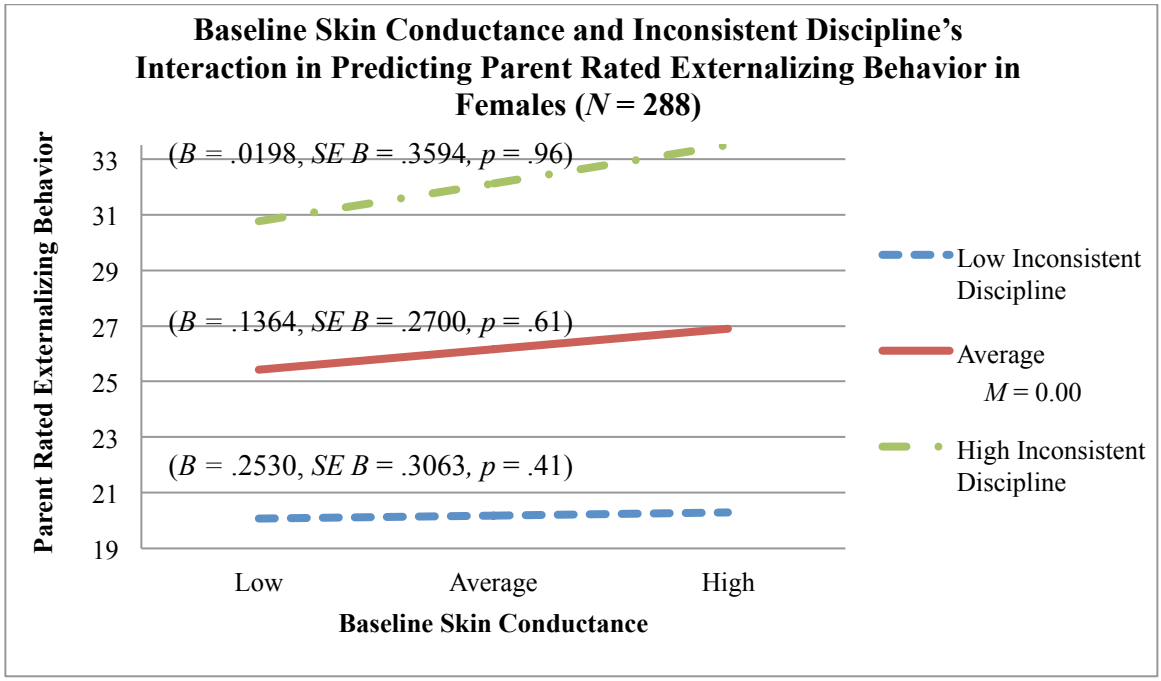

Figure 17: Baseline Skin Conductance and Inconsistent Discipline's Interaction in Predicting Parent Rated Externalizing Behavior in Females ($N = 288$)

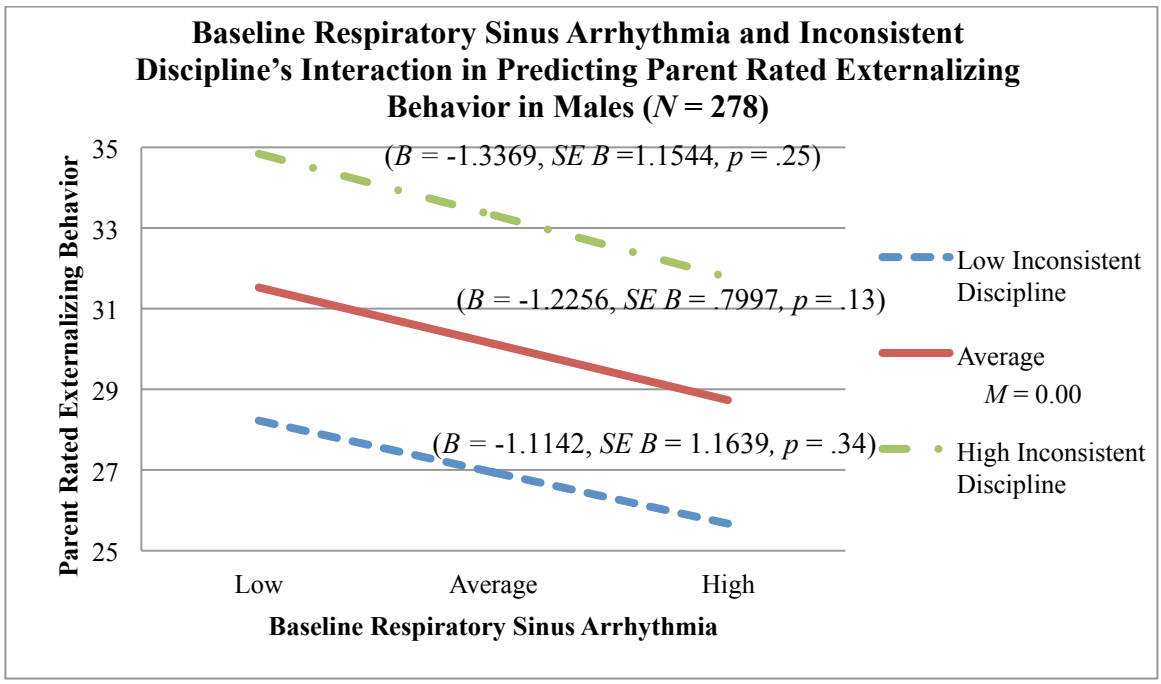

Figure 18: Baseline Respiratory Sinus Arrhythmia and Inconsistent Discipline's Interaction in Predicting Parent Rated Externalizing Behavior in Males ($N = 278$)

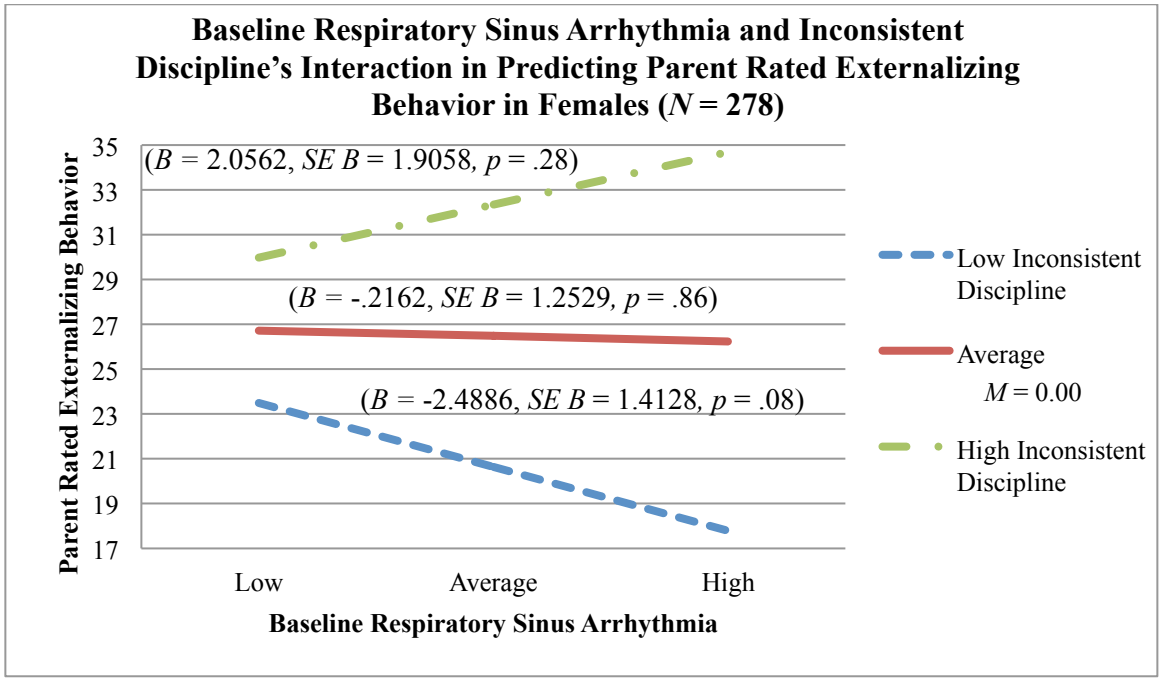

Figure 19: Baseline Respiratory Sinus Arrhythmia and Inconsistent Discipline's Interaction in Predicting Parent Rated Externalizing Behavior in Females ($N = 278$)

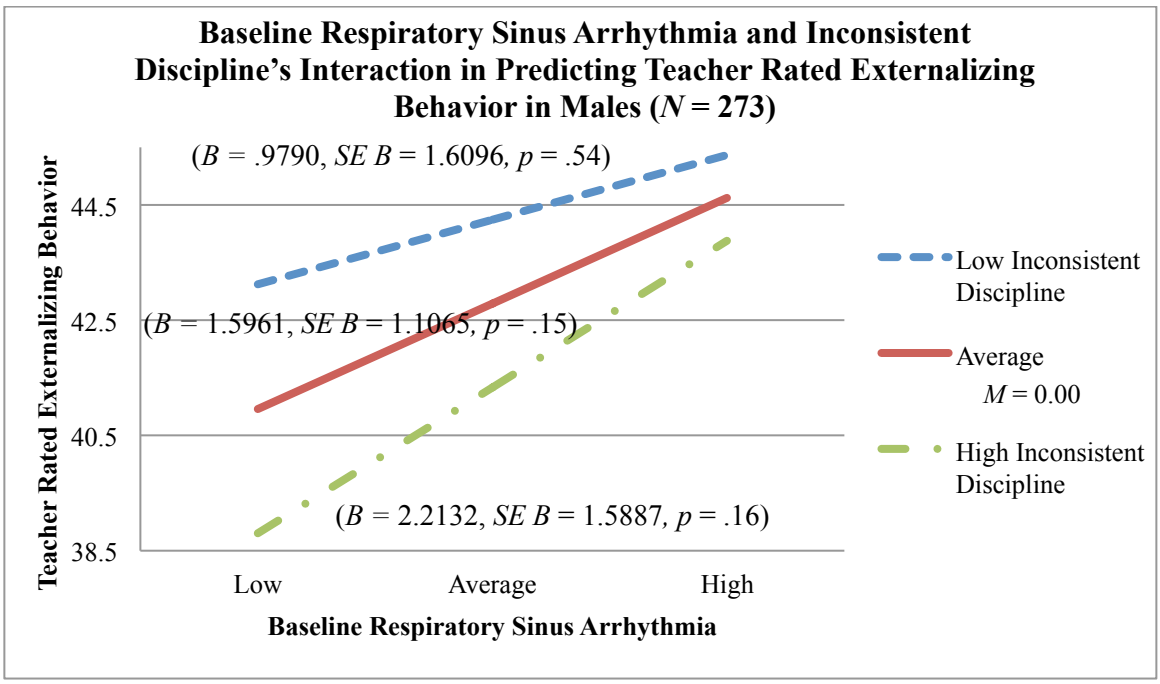

Figure 20: Baseline Respiratory Sinus Arrhythmia and Inconsistent Discipline's Interaction in Predicting Teacher Rated Externalizing Behavior in Males ($N = 273$)

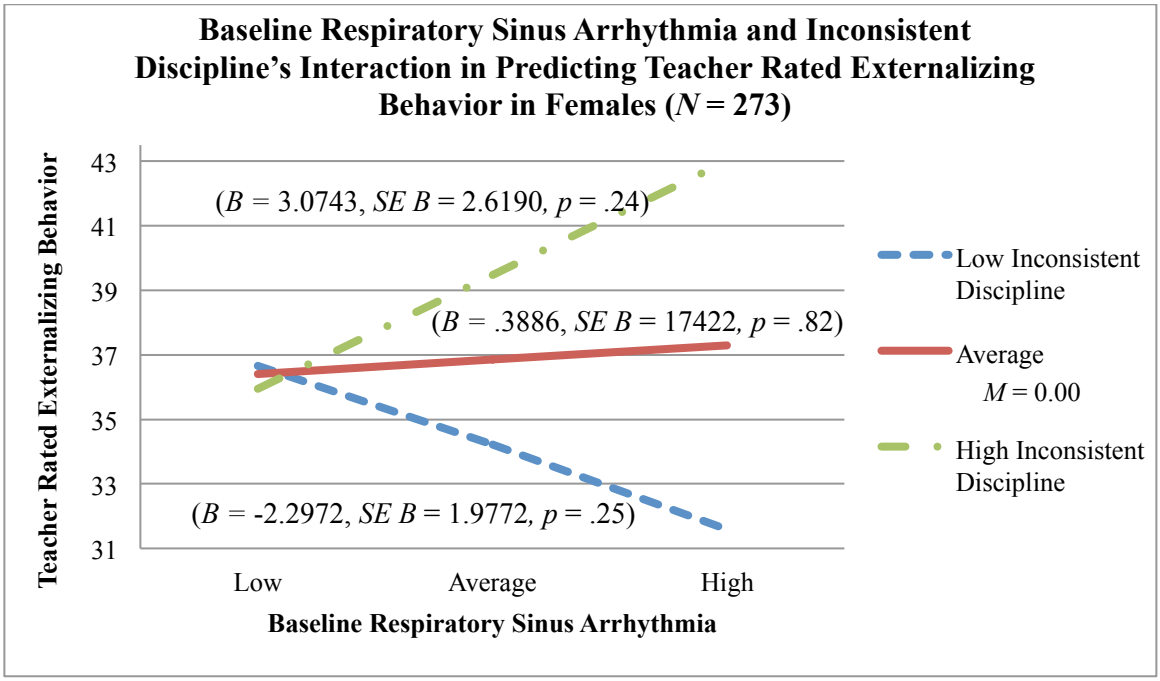

Figure 21: Baseline Respiratory Sinus Arrhythmia and Inconsistent Discipline's Interaction in Predicting Teacher Rated Externalizing Behavior in Females ($N = 273$)

Double Moderation Analyses: Income

In the following analyses yearly household income was entered as a second moderator. None of the two- or three-way interaction effects between income, autonomic arousal, and parental involvement or poor monitoring and supervision produced significant outcomes. A summary of the results for the four double moderation models for parental involvement is shown in Table 30. The four double moderation models for poor monitoring and supervision are shown in Table 28 and the four double moderation models for inconsistent discipline are shown in Table 32.

Table 30

Double Moderated Regression Analysis Summary for Parental Involvement, Income, and Autonomic Arousal's Interaction in Predicting Externalizing Behavior

		B	*SE B*	*t*	95% CI
Parent Rated Externalizing Behavior					
R^2 = .0537, *MSE* = 171.8086, *p* = .0423					
Intercept	i_1	38.7295	33.1229	1.1693	[-26.4721, 103.9310]
Baseline SCL (X)	b_1	-3.4364	3.9100	-.8789	[-18.5208, 14.3692]
P. Involvement (M)	b_2	-2.0758	8.3542	-.2485	[-11.1331, 4.2603]
Income (W)	b_3	13.4296	22.1963	.6050	[-30.2632, 57.1223]
X × M	b_4	.8465	1.0104	.8378	[-1.1424, 2.8354]
X × W	b_5	1.4849	2.7004	.5499	[-3.8307, 6.8005]
M × W	b_6	-3.9553	5.6708	-.6975	[-15.1181, 7.2075]
X × M × W	b_7	-.3245	.7098	-.4572	[-1.7218, 1.0728]
R^2 = .0506, *MSE* = 176.5732, *p* = .1012					
Intercept	i_1	31.8523	126.1398	.2525	[-216.4905, 280.1950]
Baseline RSA (X)	b_1	-1.3339	16.8472	-.0792	[-34.5026, 31.8347]
P. Involvement (M)	b_2	4.5439	31.9005	.1424	[-58.2614, 67.3493]
Income (W)	b_3	-19.7192	86.2289	-.2287	[-189.4858, 150.0473]
X × M	b_4	-.3152	4.2590	-.0740	[-8.7002, 8.0698]
X × W	b_5	4.9896	11.7108	.4261	[-18.0664, 28.0456]
M × W	b_6	2.8710	21.4995	.1335	[-39.4570, 45.1989]
X × M × W	b_7	-1.0178	2.9116	-.3496	[-6.7503, 4.7146]
Teacher Rated Externalizing Behavior					
R^2 = .0294, *MSE* = 309.4042, *p* = .3154					
Intercept	i_1	37.5976	51.3009	.7329	[-63.3949, 138.5900]
Baseline SCL (X)	b_1	-3.6351	5.8251	-.6240	[-15.1025, 7.8324]
P. Involvement (M)	b_2	-1.4558	12.5988	-.1155	[-26.2582, 23.3467]
Income (W)	b_3	-2.1196	40.6757	-.0521	[-82.1951, 77.9558]
X × M	b_4	1.2484	1.4408	.8665	[-1.5880, 4.0849]
X × W	b_5	2.8087	4.7168	.5955	[-6.4770, 12.0944]
M × W	b_6	1.9084	9.8892	.1930	[-17.5597, 21.3766]
X × M × W	b_7	-.9076	1.1582	-.7836	[-3.1877, 1.3724]
R^2 = .0195, *MSE* = 312.7487, *p* = .4168					
Intercept	i_1	-188.2289	165.7998	-1.1353	[-514.6815, 138.2238]
Baseline RSA (X)	b_1	29.5802	21.6512	1.3662	[-12.0500, 72.2104]
P. Involvement (M)	b_2	61.9618	40.3124	1.5370	[-17.4115, 141.3351]
Income (W)	b_3	147.8275	130.6267	1.1317	[-109.3708, 405.0258]
X × M	b_4	-8.0491	5.2722	-1.5267	[-18.4298, 2.3317]
X × W	b_5	-19.5446	17.0520	-1.1462	[-53.1193, 14.0301]
M × W	b_6	-41.3855	31.1798	-1.3273	[-102.7772, 20.0061]
X × M × W	b_7	5.4991	4.0749	1.3495	[-2.5242, 12.5224]

$^{\dagger}p < .10$ *$p < .05$ **$p < .01$

Table 31

Double Moderated Regression Analysis Summary for Poor Monitoring and Supervision, Income, and Autonomic Arousal's Interaction in Predicting Externalizing Behavior

		B	*SE B*	*t*	95% CI
Parent Rated Externalizing Behavior					
$R^2 = .0866$, *MSE* = 165.8309, $p < .001$					
Intercept	i_1	12.5887	13.0533	.9644	[-13.1062, 38.2837]
Baseline SCL (X)	b_1	.8734	1.8987	.4600	[-2.8640, 4.6109]
P. Monitoring (M)	b_2	11.5742	8.7604	1.3212	[-5.6704, 28.8188]
Income (W)	b_3	-1.2005	9.4268	-.1273	[-19.7568, 17.3559]
X × M	b_4	-.6531	1.2903	-.5062	[-3.1931, 1.8869]
X × W	b_5	-.0899	1.3045	-.0689	[-2.6578, 2.4779]
M × W	b_6	.0597	6.7521	.0088	[-13.2316, 13.3511]
X × M × W	b_7	.1999	.9504	.2104	[-1.6710, 2.0708]
$R^2 = .0910$, *MSE* = 169.0641, $p = .0001$					
Intercept	i_1	85.0077	54.7536	1.5525	[-22.7906, 192.8059]
Baseline RSA (X)	b_1	-8.0451	7.2471	-1.1101	[-22.3132, 6.2229]
P. Monitoring (M)	b_2	-32.2507	39.7465	-.8114	[-110.5032, 46.0019]
Income (W)	b_3	-52.9007	44.4115	-1.1912	[-140.3375, 34.5361]
X × M	b_4	4.6857	5.2676	.8895	[-5.6850, 15.0565]
X × W	b_5	6.2371	5.8987	1.0574	[-5.3762, 17.8503]
M × W	b_6	38.2652	35.4882	1.0783	[-31.6036, 108.1340]
X × M × W	b_7	-4.4772	4.6870	-.9552	[-13.7048, 4.7505]
Teacher Rated Externalizing Behavior					
$R^2 = .0347$, *MSE* = 307.717, $p = .2003$					
Intercept	i_1	12.3170	20.3927	.6040	[-27.8287, 52.4627]
Baseline SCL (X)	b_1	2.4771	2.2954	1.0792	[-2.0416, 6.9958]
P. Monitoring (M)	b_2	13.8873	13.7130	1.0127	[-13.1084, 40.8831]
Income (W)	b_3	10.3390	14.4058	.7177	[-18.0207, 38.6988]
X × M	b_4	-.8979	1.4938	-.6011	[-3.8387, 2.0429]
X × W	b_5	-.8796	1.5553	-.5655	[-3.9414, 2.1823]
M × W	b_6	-3.3311	9.9109	-.3361	[-22.8420, 16.1798]
X × M × W	b_7	.0837	.9955	.0841	[-1.8760, 2.0433]
$R^2 = .0183$, *MSE* = 313.1349, $p = .6367$					
Intercept	i_1	124.0278	71.2053	1.7418†	[-16.1723, 264.2279]
Baseline RSA (X)	b_1	-12.3490	9.3789	-1.3167	[-30.8157, 6.1177]
P. Monitoring (M)	b_2	-49.9996	50.3510	-.9930	[-149.1386, 49.1394]
Income (W)	b_3	-72.1217	53.6314	-1.3448	[-177.7196, 33.4763]
X × M	b_4	7.4495	6.6175	1.1257	[-5.5800, 20.4790]
X × W	b_5	10.1168	6.9714	1.4512	[-3.6095, 23.8431]
M × W	b_6	42.5769	41.0013	1.0384	[-38.1528, 123.3066]
X × M × W	b_7	-5.9465	5.3203	-1.1177	[-16.4219, 4.5289]

$^{\dagger}p < .10$ *$p < .05$ **$p < .01$

Inconsistent discipline. Regression analyses revealed that a two-way interaction between baseline SCL and inconsistent discipline (B = 1.2677, $SE\ B$ = .5745, p = .0281) was significant and two-way interactions between income and baseline SCL (B = 2.1282, $SE\ B$ = 1.1606, p = .0678) and income and inconsistent discipline in predicting parent rated externalizing behavior (B = 7.0331, $SE\ B$ = 4.2563, p = .0996) exhibited a non-significant trend. A plot for inconsistent discipline for households with income less than $30,000 indicated that baseline SCL was positively associated with parent rated externalizing behavior in the presence of high inconsistent discipline but was negatively associated with parent rated externalizing behavior in the presence of low inconsistent discipline (Figure 22). For households with income more than $30,000, baseline SCL was positively associated with parent rated externalizing behavior regardless of the level of inconsistent discipline (Figure 23).

In addition, a three-way interaction between income, baseline SCL, and inconsistent discipline in predicting teacher rated externalizing behavior (B = -1.2969, $SE\ B$ = .6336, p = .0416) was significant and two-way interactions between income and baseline SCL (B = 13.1820, $SE\ B$ = 6.7452, p = .0517) and baseline SCL and inconsistent discipline (B = 1.6863, $SE\ B$ = .9046, p = .0634) exhibited a non-significant trend. A plot for inconsistent discipline for households with income less than $30,000 indicated that baseline SCL was positively associated with teacher rated externalizing behavior in the presence of high inconsistent discipline (Figure 24). For households with income greater than $30,000, baseline SCL was positively associated with teacher rated externalizing behavior in the presence of low inconsistent discipline, but negatively associated with teacher rated externalizing behavior in the presence of high inconsistent discipline (Figure 25). Overall, the level of inconsistent discipline was most influential on children's teacher rated externalizing behavior for children with low baseline SCL

regardless of yearly household income. For households with income less than $30,000, when there was low baseline SCL, high inconsistent discipline was related to lower levels of teacher rated externalizing behavior. When there was low baseline SCL, low inconsistent discipline was related to higher levels of teacher rated externalizing behavior. However, for households with income more than $30,000, these relationships were reversed. For instance, for children with low baseline SCL, high inconsistent discipline was related to high levels of teacher rated externalizing behavior. Under conditions of high baseline SCL, inconsistent discipline makes little difference on children's teacher rated externalizing behavior across both income levels. A summary of the results for the four moderation models for inconsistent discipline is shown in Table 32.

Table 32

Double Moderated Regression Analysis Summary for Inconsistent Discipline, Income, and Autonomic Arousal's Interaction in Predicting Externalizing Behavior

		B	*SE B*	*t*	95% CI
Parent Rated Externalizing Behavior					
$R^2 = .1273$, *MSE* = 158.4424, $p < .001$					
Intercept	i_1	42.4581	14.1989	2.9902**	[14.5078, 70.4083]
Baseline SCL (X)	b_1	-3.4443	1.4884	-2.3141*	[-6.3740, -.5145]
Inconsistent Discipline (M)	b_2	-4.9987	5.5109	-.9071	[-15.8467, 5.8493]
Income (W)	b_3	-18.4753	10.1298	-1.8239†	[-38.4155, 1.4649]
X × M	b_4	1.2677	.5745	2.2068*	[.1369, 2.3985]
X × W	b_5	2.1282	1.1606	1.8337†	[-.1564, 4.4128]
M × W	b_6	7.0331	4.2563	1.6524†	[-1.3452, 15.4115]
X × M × W	b_7	-.7566	.4766	-1.5875	[-1.6948, .1816]
$R^2 = .1188$, *MSE* = 163.8886, $p < .001$					
Intercept	i_1	53.8909	61.8319	.8716	[-67.8432, 175.6250]
Baseline RSA (X)	b_1	-4.6023	7.8841	-.5837	[-20.1245, 10.9199]
Inconsistent Discipline (M)	b_2	-1.7994	24.9029	-.0723	[-50.8279, 47.2291]
Income (W)	b_3	-11.2929	44.6098	-.2531	[-99.1202, 76.5344]
X × M	b_4	.7785	3.1906	.2440	[-5.5031, 7.0600]
X × W	b_5	.9598	5.6174	.1709	[-10.0997, 12.0194]
M × W	b_6	1.0512	19.2782	.0545	[-36.9036, 39.0061]
X × M × W	b_7	.0805	2.4442	.0330	[-4.7316, 4.8927]
Teacher Rated Externalizing Behavior					
$R^2 = .0321$, *MSE* = 308.5546, $p = .2495$					
Intercept	i_1	72.6608	23.3140	3.1166**	[26.7642. 118.5574]
Baseline SCL (X)	b_1	-2.8998	2.4447	-1.8025	[-7.7124, 1.9129]
Inconsistent Discipline (M)	b_2	-17.0450	9.4564	-1.1862†	[-35.6612, 1.5711]
Income (W)	b_3	-25.3091	15.7181	-1.6102	[-56.2522, 5.6341]
X × M	b_4	1.6863	.9046	1.8642†	[-.0944, 3.4671]
X × W	b_5	2.3306	1.6404	1.4121	[-.9184, 5.5797]
M × W	b_6	13.1820	6.7452	1.9543†	[-.0968, 26.4607]
X × M × W	b_7	-1.2969	.6336	-2.0468*	[-2.5443, -.0495]
$R^2 = .0213$, *MSE* = 312.1586, $p = .7128$					
Intercept	i_1	40.4722	78.3044	.5169	[-113.7058, 194.6501]
Baseline RSA (X)	b_1	-.1344	10.4414	-.0129	[-20.6930, 20.4242]
Inconsistent Discipline (M)	b_2	8.9441	31.7068	.2821	[-353.4852, 71.3735]
Income (W)	b_3	21.0496	56.7127	.3712	[-90.6153, 132.7145]
X × M	b_4	-.1344	4.2540	-.2769	[-9.5540, 7.1979]
X × W	b_5	-2.7156	7.5084	-.3617	[-17.4994, 12.0682]
M × W	b_6	-17.3072	23.3440	-.7414	[-63.2706, 28.6562]
X × M × W	b_7	2.3158	3.1371	.7382	[-3.8610, 8.4925]

†$p < .10$ *$p < .05$ **$p < .01$

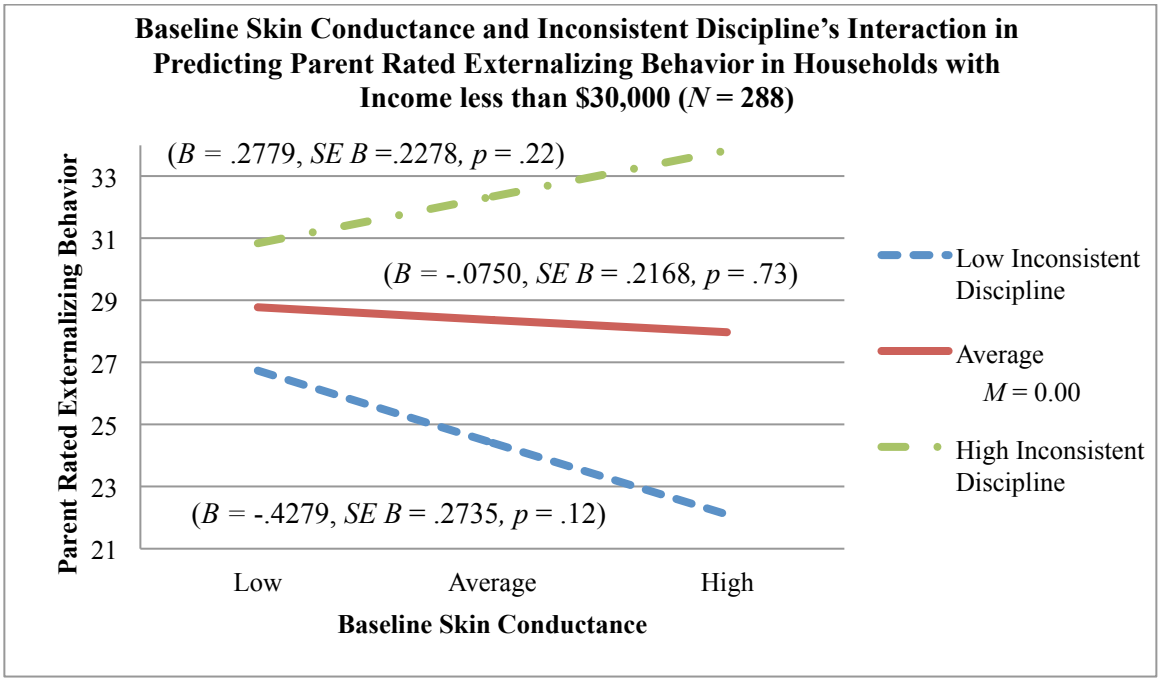

Figure 22: Baseline Skin Conductance and Inconsistent Discipline's Interaction in Predicting Parent Rated Externalizing Behavior in Households with Income less than $30,000 ($N = 288$)

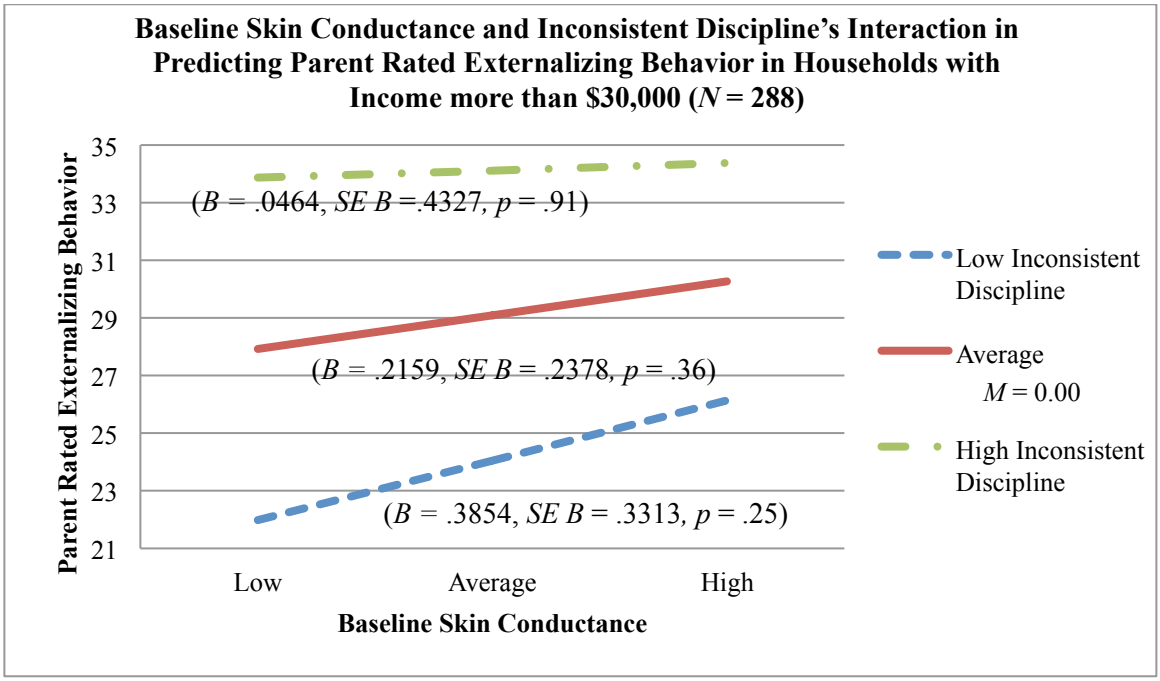

Figure 23: Baseline Skin Conductance and Inconsistent Discipline's Interaction in Predicting Parent Rated Externalizing Behavior in Households with Income more than $30,000 ($N = 288$)

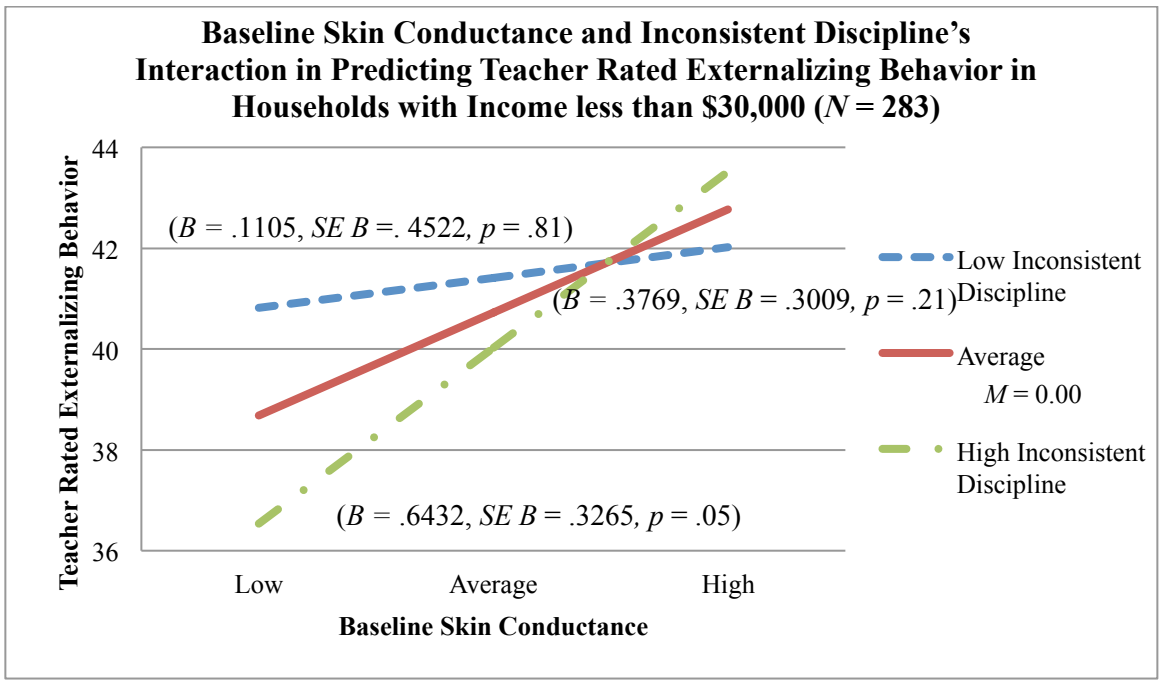

Figure 24: Baseline Skin Conductance and Inconsistent Discipline's Interaction in Predicting Teacher Rated Externalizing Behavior in Households with Income less than $30,000 ($N = 283$)

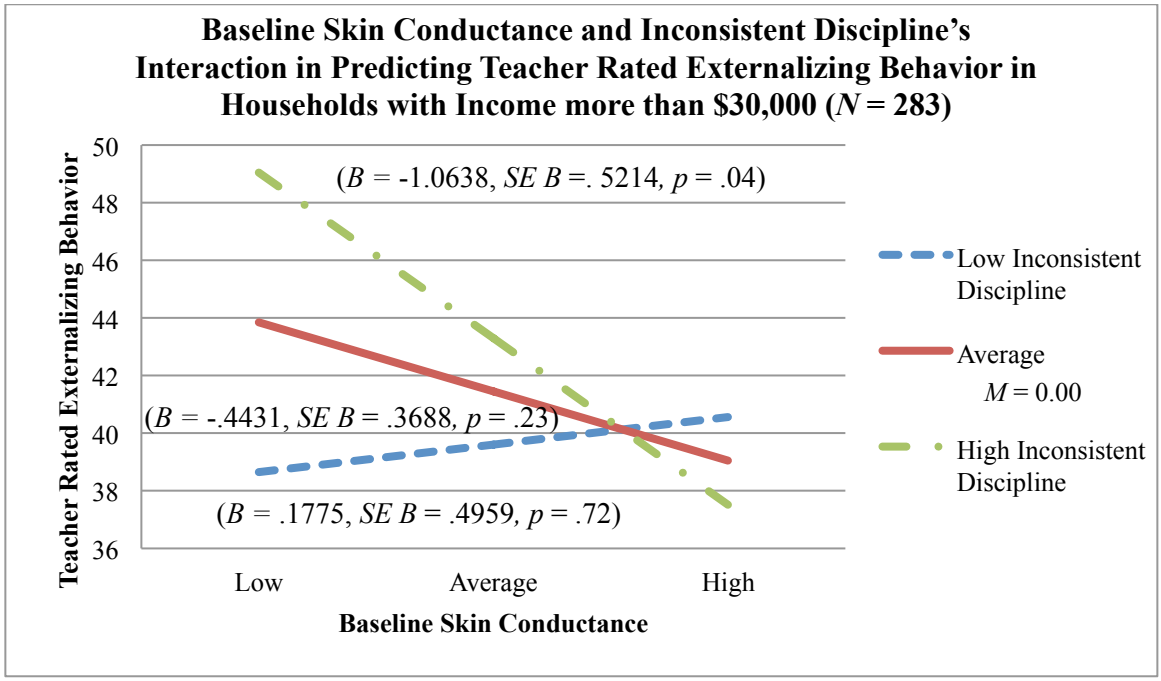

Figure 25: Baseline Skin Conductance and Inconsistent Discipline's Interaction in Predicting Teacher Rated Externalizing Behavior Households with Income more than $30,000 ($N = 283$)

Summary. Of the twelve double moderated regression analyses that examined gender as an additional moderator, 2 three-way interactions and 5 two-way non-significant interactions trended towards significance. Of the twelve double moderated regression analyses that examined yearly household income as an additional moderator, 1 three-way and 1 two-way interaction were found to be significant, while 4 two-way non-significant interactions trended towards significance. A summary of the double moderation results for gender and income in predicting parent rated externalizing behavior is shown in Table 33, while a summary of the double moderation results for gender and income in predicting teacher rated externalizing behavior is presented in Table 34.

Table 33

Summary of Double Moderation Results for Gender and Income in Predicting Higher Levels of Parent Rated Externalizing Behavior

	Parental Involvement	Poor Monitoring and Supervision	Inconsistent Discipline
Baseline SCL	---	---	Less than $30,000: High baseline SCL with high inconsistent discipline Low baseline SCL with low inconsistent discipline More than $30,000: High baseline SCL for all Males: High baseline SCL with high inconsistent discipline Low baseline SCL with low inconsistent discipline Females: High baseline SCL for all
Baseline RSA	---	---	Males: Low baseline RSA for all Females: High baseline RSA with high inconsistent discipline Low baseline RSA with low inconsistent discipline*

†slope *at* $p < .10$ *significant slope at $p < .05$ **significant slope at $p < .01$

Table 34

Summary of Double Moderation Results for Gender and Income in Predicting Higher Levels of Teacher Rated Externalizing Behavior

	Parental Involvement	Poor Monitoring and Supervision	Inconsistent Discipline
Baseline SCL	---	Males: Low baseline SCL with low monitoring and supervision High baseline SCL with high monitoring and supervision Females: High baseline SCL for all	Less than $30,000: High baseline SCL with low inconsistent discipline Low baseline SCL with high inconsistent discipline* More than $30,000: Low baseline SCL with high inconsistent discipline* High baseline SCL with low inconsistent discipline
Baseline RSA	Males: High baseline RSA for all Females: Low baseline SCL with high parental involvement High baseline SCL with low parental involvement	Males: High baseline RSA for all Females: Low baseline RSA with low monitoring and supervision High baseline RSA with high monitoring and supervision	Males: High baseline RSA for all Females: High baseline RSA with high inconsistent discipline Low baseline SCL with low inconsistent discipline

†slope *at* $p < .10$ *significant slope at $p < .05$ **significant slope at $p < .01$

CHAPTER V

DISCUSSION

Despite the plethora of research devoted to externalizing behaviors in children, many unclear findings remain in the area of moderating influences of parenting practices and autonomic arousal. The purpose of this research study was to examine parental involvement, poor monitoring and supervision, and inconsistent discipline as moderators in the relationship between autonomic arousal and externalizing behaviors in an at-risk sample of children. This study also investigated how demographic variables such as gender and yearly household income impacted these relationships. As discussed in previous chapters, this study utilized existing data collected from a randomized controlled trial conducted with a sample of elementary school children who have demonstrated moderate to high levels of aggressive behavior.

This chapter is organized around the four research questions and the two exploratory research questions that were presented in previous chapters. The following directional hypotheses were investigated in response to the four research questions presented in previous chapters:

1a. In the presence of high inconsistent discipline there, will be a significant negative relationship between baseline SCL and externalizing behaviors in children.

1b. In the presence of low parental involvement there, will be a significant negative relationship between baseline SCL and externalizing behaviors in children.

1c. In the presence of poor parental monitoring, there will be a significant negative relationship between baseline SCL and externalizing behaviors in children.

2a. In the presence of high inconsistent discipline there, will be a significant negative relationship between baseline RSA and externalizing behaviors in children.

2b. In the presence of low parental involvement there, will be a significant negative relationship between baseline RSA and externalizing behaviors in children.

2c. In the presence of poor parental monitoring, there will be a significant negative relationship between baseline RSA and externalizing behaviors in children.

3a. In the presence of high inconsistent discipline there, will be a significant positive relationship between SCL reactivity and externalizing behaviors in children.

3b. In the presence of low parental involvement there, will be a significant positive relationship between SCL reactivity and externalizing behaviors in children.

3c. In the presence of poor parental monitoring, there will be a significant positive relationship between SCL reactivity and externalizing behaviors in children.

4a. In the presence of high inconsistent discipline there, will be a significant positive relationship between RSA reactivity and externalizing behaviors in children.

4b. In the presence of low parental involvement there, will be a significant positive relationship between RSA reactivity and externalizing behaviors in children.

4c. In the presence of poor parental monitoring, will be a significant positive relationship between RSA reactivity and externalizing behaviors in children.

Results for the four research questions and twelve corresponding hypotheses investigated in this study were all found to be nonsignificant. The parenting practices examined in this study were not supported as moderators in the relationship between autonomic arousal and externalizing behavior.

The remainder of this discussion chapter covers several major sections. First, implications of the main effects of parenting practices are highlighted. Second, implications of the main effects of autonomic arousal are presented. Third, the moderating role of parenting practices and exploratory analyses examining the components of externalizing behavior are addressed. In summation, the limitations of the current study are acknowledged and the need for further research is highlighted.

Main Effect of Parenting Practices

Consistent with previous research, the current results revealed that parenting practices are important factors in the current association and maintenance of children's externalizing behavior (Linver et al., 2002). Each of the twelve regression analyses examining parent rated externalizing behaviors as the outcome variable found parenting practices to be significant predictors. Children who come from households where there is low parental involvement, low monitoring and supervision, or inconsistent discipline practices have higher levels of parent rated externalizing behavior.

Indeed, conclusions from the current study regarding the main effects of parenting practices are consistent with previous research findings. For instance, parental monitoring and supervision has been shown to be a consistent predictor of positive child development and a protective factor for problem behavior (Crouter & Head, 2002). Parents who spend limited time supervising and monitoring their child may be unaware of problem behaviors, which makes it difficult for parents to punish externalizing behavior and reinforce more positive behaviors. Similarly, a lack of parental involvement is also a strong predictor of externalizing behavior problems (Loeber & Stouthamer-Loeber, 1986). This lack of parental monitoring and supervision or parental involvement also creates opportunity for children to associate with deviant peer groups

and engage in more risky behaviors such as alcohol and drug use (Dishon & McMahon, 1998). Further, a lack of rules in combination with negative and inconsistent parenting practices has also been found in the literature to be predictive of externalizing behavior problems (Bor et al., 2002; Stormshak et al., 2000). Overall, findings from parent reported models support that parental involvement, monitoring and supervision, and inconsistent discipline practices have a direct effect on the development and maintenance of externalizing behavior problems.

However, these results were not consistent across informants of children's behavior. Regression analyses revealed that parenting practice was not a predictor in any of the twelve models that examined teacher rated externalizing behavior. According to a meta-analysis by Achenback, McConaughy, and Howell (1987), reporting of child externalizing behavior is often not highly correlated among sources. Specifically, agreement was found to be small ($r = .28$) across parent-teacher informants (Achenbach et al., 1987).

In the current study, parent and teacher ratings were similarly moderately correlated ($r = .292$, $p < .01$). The lack of associations between parenting practices and teacher rated externalizing behavior suggests that the influence of parenting on child behavior is not as pronounced within the confinements and structure of the school setting. Different variables may trigger externalizing behaviors within the school context. According to the bioecological systems theory (Bronfenbrenner, 2001; Bronfenbrenner & Ceci, 1994), there are many contextual factors and interaction patterns that occur with the school setting. For example, peer relationships (Stormshak, Bierman, & The Conduct Problems Prevention Research Group, 1998) and the student-teacher relationship rather than the parent-child relationship may be more predictive of problem behavior within the school setting (Myers & Pianta, 2008).

Main Effect of Autonomic Arousal

Five regression analyses out of twelve found autonomic arousal to be significant predictors of parent rated externalizing behavior. Previous research examining the relationship of autonomic arousal and externalizing behavior has produced mixed results. For example, Dietrich et al. (2007) found there to be no relationship between RSA reactivity and externalizing behavior. However, in the current study, RSA reactivity was found to be positively associated with parent rated externalizing behavior. The overall pattern of these findings indicated that higher levels of RSA reactivity were associated with higher levels of parent rated externalizing behavior. Children with poor emotional regulation indicated by high RSA reactivity emit more externalizing behavior. These findings are complimentary to those of Hinnant and El-Sheikh (2009) and Vasilev et al. (2009), who found lower RSA reactivity to promote a state-like physiological response that promotes self-regulation and coping in a community sample of children. The results of the parent-report models analyzing RSA reactivity add to the current body of research by demonstrating that parasympathetic functioning predicts child behavior. The present results also extend prior research by demonstrating that the predicted relationships are indicated in an at-risk population of preadolescent children.

SNS functioning was not found to be predictive of parent or teacher rated externalizing behavior. When activated, the SNS mobilizes resources needed to behaviorally respond to the environment (Boucsein, 2011). The current results indicate that the PNS is more powerfully associated with parent rated externalizing behavior within this at-risk sample of children. This suggests that within this at-risk population of preadolescent children, it is not the activation of SNS in response to the stressor that is most influential, but rather how they manage and recover from the environmental stressor. The polyvagal theory suggests the vagal system plays an

important role in preserving physiological homeostasis (Porges, 1995). According to this theory, adaptive changes in RSA allow for the allocation of resources to effectively manage an environmental stressor (Porges, 2007). Thus, a reduction of PNS (low RSA reactivity) activity in response to stress, allows for SNS activity to provide the body with resources to respond to a stressful situation, whereas increases of RSA (high RSA reactivity) in response to stress deprives the body of the resources needed to manage the stress.

Similar to the findings of the main effect of parenting practices, measures of autonomic arousal were not found to be significant predictors of teacher rated externalizing behavior. Not only are parent and teacher ratings not found to be highly correlated (Achenback, et al., 1987), but also prior research has shown that parents and teachers tend to report on different behaviors. According to Bank, Duncan, Patterson, and Reid (1993), parents were found to focus more on the smaller more irritating behaviors (e.g., screams, stubborn, argues) while teachers tended to report on a smaller number of more serious behaviors (e.g., physically attacks, threatens, fights, hangs around troublemakers). This finding suggests that parent reports and teacher reports of child behavior may differ. It is possible that teachers may have a higher threshold for what constitutes problematic behavior than parents. Findings from a study by Gizer et al. (2008), suggest that utilizing multiple sources is highly informative even though parent ratings are independent of teacher ratings. In the present study, the use of parent and teacher ratings, though different, provided rich information about how behavior presents differently in different settings for at-risk children.

Moderation of Parenting Practices and Autonomic Arousal on Externalizing Behavior

Parental involvement, poor monitoring and supervision, and inconsistent discipline were not found to be significant moderators in the relationship between autonomic arousal and parent

or teacher rated externalizing behavior. The current study utilized a sample of children who were screened for moderate to high levels of aggressive behavior. Due to the specificity of the sample and similarity in demographic characteristics, it is possible that a general look at the externalizing behavior composite score was not precise enough to detect individual differences within the child. Due to nonsignificant results with the externalizing composite score, additional exploratory analyses were conducted to further examine the externalizing subscales for a closer look at the specific behaviors of aggression, conduct problems, and hyperactivity. Additionally, double-moderated regression analyses were run with gender and income to explore the interaction of specific demographic characteristics.

Exploratory Analyses

Moderation of parenting practices and autonomic arousal on externalizing subscales. When individual parent rated externalizing subscales (i.e., aggression; conduct problems; hyperactivity) were examined, three non-significant models trended towards significance. However, no moderated analyses examining parent ratings of behavior were close to significance. Through further examination of teacher rated externalizing subscales, one of twelve teacher rated hyperactivity models produced a significant positive moderating interaction with baseline RSA and inconsistent discipline. Previous research by Calkins et al. (2007) found no significant relationship between baseline RSA and externalizing behaviors, while other studies have found baseline RSA to be inversely related to externalizing behaviors, where low baseline has been associated with vulnerability to environmental stress and poor emotion regulation (Beauchaine, Gatze-Kopp, & Mead, 2007). In the current study, higher levels of baseline RSA were associated with higher levels of teacher rated hyperactivity in the presence of higher exposure to inconsistent discipline practices.

It is possible that the discrepancy between previous research and the current study are due to the influence of environmental risk factors in an at-risk sample of preadolescent children. For example, Scarpa, Tanaka, and Chiara-Haden (2008) proposed that high levels of baseline RSA may result in increased impulsivity and risk-taking in reactive aggressive children. Calkins and Fox (1992) proposed a model in which parenting style may influence and change one's physiological response. According to this model, two possibilities for high baseline RSA are possible. If adequate parenting practices are present, the child will be socially competent and appropriately expressive to environmental stressors, whereas a lack of specific parenting practices may result in aggressive and emotionally unregulated children. In addition, it is possible that higher levels of inconsistent discipline results in an unpredictable home environment, which may lead to the development of a maladaptive parasympathetic response.

It is worth noting that this relationship was not present for parent ratings of hyperactivity. It is possible that hyperactivity may present differently within the home context than in the school setting. In the home setting where parenting discipline practices are inconsistent, is it possible that hyperactivity may simply go unnoticed by the parent due to the lack of structure within the environment. However, within the school context, the classroom environment may provide not only structure but also consistent rules and expectations that may increase the chances that behavior problems (i.e., hyperactivity) will be noticed and reported.

Additionally, this model accounted for only 6% of the overall variance of teacher rated hyperactivity. Though there was a significant interaction, this relationship only accounted for a small portion of the variance. Further research is needed to determine what other relationship(s) more powerfully impacts child behavior.

Gender. Multiple regression analyses in the current study revealed the main effect of gender as a significant predictor of teacher rated externalizing behavior in twelve models and a significant predictor of parents rated externalizing behavior in six of twelve models. In the remaining six parent-rated models, gender trended towards significance. All twenty-four models revealed a negative relationship demonstrating higher externalizing behaviors were associated with the male gender. These findings are consistent with previous research, which found overall levels of externalizing behavior to be higher for males than for females (Bongers et al., 2004; Tung et al., 2012). It is important to highlight that in the current study, gender is the only predictor that significantly predicts externalizing behavior across informants. Both parent and teacher ratings of externalizing behavior indicate gender as being related to behavior displayed across settings and is not simply related to bias resulting from the use of a single source.

Double moderated multiple regression analyses did not support gender as an additional moderator with parenting practices in the relationship between autonomic arousal and parent or teacher rated externalizing behavior. Similar to the primary analyses explored in the current study, it is possible that the externalizing composite was not stringent enough to detect individual differences in the current sample. Further review of these relationships with the externalizing subscales (i.e., aggression, conduct problems, hyperactivity) is warranted.

Income. Interactions between sociocultural, biological, and environmental level risk factors have been found to put children at risk for externalizing behavior problems (Bronfenbrenner, 2001; Deater-Deckard et al., 1998). In the current study, yearly household income was dichotomized into "earns less than $30,000" and "earns more than $30,000." The main effect of income was not found to be a significant predictor of parent or teacher rated externalizing behavior. However, research has shown that poverty is among the greatest risk

factors for childhood externalizing behavior problems (Linver et al., 2002) and is often linked through its impact on caregivers (Frick & Munoz, 2006). It is possible that some information was lost when yearly household income was dichotomized. Future research should consider more meaningful groupings of yearly household income levels.

One three-way interaction was found to be significant. Specifically, one of twelve models found yearly household income to be a significant moderator along with inconsistent discipline in the relationship between autonomic arousal and teacher rated externalizing behavior. When examining teacher rated externalizing behavior in the context of high levels of inconsistent discipline, households with income less than $30,000 exhibited negative relationships between baseline SCL and externalizing behavior. Research supports inconsistent discipline as a significant risk factor for the development of externalizing behaviors in children (Stormshak et al., 2000). Given that the sample was predominately from households with income less than $30,000, it is possible that living in these environments affected children's biology through chronic activation of stress (Essex et al., 2002) and parenting practices, as additional worries about finances may undermine parenting and the parent-child relationship (Acri et al., 2017; Bronfenbrenner, 1999). Thus, findings from the current study add to the accumulation of evidence that suggest yearly household income plays an important role in the development of child behavior (Dodge et al., 1994; Linver et al., 2002; Tremblay et al., 2004). It is important to note that this relationship only accounted for 3% of the total variance of teacher rated externalizing behavior.

Limitations

This study presents novel findings that will aid in better conceptualizing the association and maintenance of externalizing behavior in youth at-risk for moderate to high levels of

aggression. However, the results should be interpreted within the contexts with which they were derived. The first limitation of the study involved the sample. Specifically, the sample included children, ages 9 – 11, who screened for moderate to high levels of aggressive behavior. Further, the sample included largely African American males and children from low income earning families in the southeastern part of the United States. Given the specificity of the sample, the results cannot be generalized to other populations. However, the findings of this study provide grounding for further research with more diverse populations. Second, the APQ (Shelton et al., 1996), a self-reported measure was used for the assessment of parenting practices. The use of self-reported measures may produce inaccuracies because of socially desirable response bias. Although this self-reported measure was utilized, the present study uses various sources of information with autonomic arousal measured directly from the child and both parent and teacher reports of child externalizing behavior. By including three sources of data, the present study avoided relying entirely on self-reported data or data collected from a single source. In addition, significant findings for interaction effects need to be considered in the context of the number of analyses that were run. Further, the use of both parent and teacher reports of externalizing behavior also considered child behaviors within the school setting as well as the home. Additionally, analyses utilized varying subsamples due to missing data. Most missing data in the current study was due to missing physiological data. The final limitation of note is the use of cross-sectional data. Analysis of cross-sectional data inhibits the ability to establish temporal directionality, and thus, causality. Without longitudinal data, the researcher is only able to establish meaningful associations among the study variables. With longitudinal data, causal links could be inferred and tested.

Recommendations for Future Research

This study has implications for future research. The findings of the current study indicate that future research pertaining to the moderating role of parenting practices on the relationship of autonomic arousal and externalizing behaviors could be further improved and successfully accomplished based on the following recommendations:

- The current study utilized a composite score composed of three subscales. Moderation regression analyses in the current study were nonsignificant. Through further examination, secondary analyses run in the current study produced interesting results when models examined externalizing behavior subscales individually. Therefore, future research should examine externalizing behavior with more specificity. By looking at behavior with more precision, one may better understand development of behaviors and the influence of contextual and environmental factors in at-risk samples.
- In the future, it will also be important to analyze the relationships examined in the current study separately by gender.
- Further, analyses are warranted for the examination of gender and income as double moderators when the outcome variables are specific externalizing behavior subscales (i.e., aggression, conduct problems, hyperactivity).
- Family structure was not controlled for in the current study. Children were recruited from single parent and two parent households, and some children lived with grandparent(s), adopted families, and families with more than one child. Future studies should consider examining how these relationships present when examined within specific household units.
- A measurement strategy using observations of parent-child interactions or a multi-method,

multiple-reporter strategy to decrease social desirability pressures that may be experienced by a single source may better assess parenting practices.

- It is recommended that future research examine how parenting practices may moderate the relationship between autonomic arousal and externalizing behavior overtime. A longitudinal study will also afford researchers an opportunity to further examine how these behaviors manifest overtime. Longitudinal data may allow the researcher to examine more specifically and powerfully how these variables affect each other causally.
- The current study did not account for internalizing problems. It is recommended that future studies examine internalizing problems within this relationship. Previous research has indicated that the influence and result of autonomic arousal vary for children with both internalizing and externalizing behavior problems (Calkins et al., 2007).
- It is recommended that future research utilize measures that have been more recently normed. The current study utilized the BASC-TRS (Reynolds & Kamphaus, 1992), BASC-PRS (Reynolds & Kamphaus, 1992), APQ (Shelton et al., 1996), and the IGT (Bechara et al., 1994). Each of these measures were developed and/or normed in the 1990s.
- Although yearly household income was correlated with race in the current study, race may have been a confounding variable in this study. Further exploration of the interrelation of income and race as they relate to the relationships examined in the current study is warranted.

Summary

The purpose of this study was to examine the influence of parental involvement, poor monitoring and supervision, and inconsistent discipline on the relationship between autonomic

arousal and externalizing behavior. Though the purpose of the study was accomplished, this research study found no statistically significant results for any of the research questions and hypotheses. This study sought to fill a gap in the current literature by examining how the study variables present in an at-risk sample of preadolescent children. Despite the lack of significant results for the planned hypotheses, exploratory analyses produced useful findings about the complex relationships among these behavioral, physiological, and contextual constructs. For instance, findings suggested that the examination of externalizing behavior as a composite score might have been too broad to examine individual differences in an at-risk sample of children with similar levels of aggressive behavior.

The findings added to and expanded the current literature on the direct effect of autonomic arousal and parenting practice on externalizing behavior in an at-risk sample of preadolescent children. For instance, five predictor variables (i.e., parental involvement, poor monitoring and supervision, inconsistent discipline, gender, and RSA reactivity) predicted parent rated externalizing behavior, while gender was the single predictor of teacher rated externalizing behavior. This provided a unique look into how the predictor variables manifest themselves in different environments. Results from this study suggest that the treatment and prevention of externalizing behavior needs to be addressed differently according to social context. For example, in the home setting, treatment may target parent training to increase parental involvement, and consistency use of effective monitoring, supervision, and discipline strategies. However, in the school setting, treatment and prevention strategies might focus on school specific variables (e.g., student-teacher relationship, peer relations).

This study also highlighted the main effects of sympathetic and parasympathetic functioning, which suggest that at-risk preadolescents are maladaptively regulated. For example,

higher RSA reactivity indicated that at-risk youth have inflexible parasympathetic responding, which negates sympathetic activation. This main effect of RSA reactivity demonstrates that parasympathetic functioning predicts child behavior over SNS functioning in an at-risk sample of children. Additionally, physiological response patterns in at-risk children appear to be more convoluted than originally suggested. The current study found higher levels of baseline RSA to be associated with higher ratings of teacher rated hyperactivity in the presence of high inconsistent discipline. This suggests that externalizing behaviors may not be entirely characterized by a single pattern of autonomic arousal (e.g., low baseline).

Overall, these results confirm the influence of bioecological interactions on externalizing behavior in an at-risk sample of children and point to a nuanced and complicated picture of the development and maintenance of externalizing behaviors. Increased knowledge and understanding of how biological, child-specific, sociocultural, and environmental factors work together to predict externalizing behavior allows for more focused prevention and intervention strategies. Ultimately, this study highlighted relationships among the study variables that will serve to contribute to future research, treatment, and prevention of externalizing behavior in at-risk children.

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APPENDIX A

IRB Form

Revised 12-10-2002

IRB Project # : 08-016 -R10

UNIVERSITY OF ALABAMA
INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS

REQUEST FOR APPROVAL OF RESEARCH INVOLVING HUMAN SUBJECTS

I. Identifying information

	Principal Investigator	Second Investigator	Third Investigator
Names:	**John E. Lochman, Ph.D.**		
Department:	**Psychology**		
College:	**Arts and Sciences**		
University:	**University of Alabama**		
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Title of Research Project: **Individual and Group Intervention Formats with Aggressive Children**
Date Submitted: **12-07-2017**
Funding Source: **National Institutes on Drug Abuse**

Type of Proposal:	___New	_X_Revision	_X_Renewal Please attach a renewal application	___Completed	___Exempt
			Please attach a continuing review of studies form		
		Please enter the original IRB # at the top of the page			

UA faculty or staff member signature: _____

II. NOTIFICATION OF IRB ACTION (to be completed by IRB):

Type of Review: _X_Full board _____Expedited

IRB Action:

___ Rejected Date:_____
___ Tabled Pending Revisions Date:_____
___ Approved Pending Revisions Date:_____
_X_ Approved—this proposal complies with University and federal regulations for the protection of human subjects. 1/17/2019

Approval is effective until the following date:
Items approved:
_X_ Research protocol (dated_____)
_X_ Informed consent (dated_____)
___ Recruitment materials: (dated_____)
___ Other: (dated_____)

Approval signature [redacted] Date 1-18-18

APPENDIX B

Agreement for Use of Data

December 1, 2017

Agreement for Use of Data from
Individual and Group Intervention Formats with Aggressive Children Research Study

Secondary analyses using preexisting data that has been deidentified will be used to examine the following proposed research questions for my doctoral dissertation: (1) Does parenting practice affect the relationship between baseline SCL and externalizing behaviors in children; (2) Does parenting practice affect the relationship between baseline RSA and externalizing behaviors in children; (3) Does parenting practice affect the relationship between SCL reactivity and externalizing behaviors in children; (4) Does parenting practice affect the relationship between RSA reactivity and externalizing behaviors in children.

This agreement is for the use of the following Time 1 participant data collected using the following instruments:

Personal Demographic Form
Alabama Parenting Questionnaire
Behavior Assessment Scale for Children – Parent Report
Behavior Assessment Scale for Children – Teacher Report
Physiological Measures

The data described above will be used for my doctoral dissertation of which I will be the sole author. Subsequent articles from the dissertation would include John E. Lochman as secondary author.

[redacted]

Devon E. Romero, MA
Doctoral Candidate
The University of Alabama

[redacted]

John E. Lochman, Ph.D.
Interim Director, Alabama Life Research Institute
Professor And Doddridge Saxon Chairholder in Clinical Psychology
Director, Center for Prevention of Youth Behavior Problems
The University of Alabama