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Socioeconomic Status Influence on Mothers’ Interactions with Infants: Contributions to Early Infant Development

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SOCIOECONOMIC STATUS INFLUENCE ON MOTHERS’ INTERACTIONS WITH INFANTS: CONTRIBUTIONS TO EARLY INFANT DEVELOPMENT

by

Krista L. Gurko

A dissertation submitted in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Family and Human Development

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2018
ABSTRACT

Socioeconomic Status Influence on Mothers’ Interactions with Infants:
Contributions to Early Infant Development

by

Krista L. Gurko, Doctor of Philosophy
Utah State University, 2018

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Children from different socioeconomic backgrounds have divergent academic, language, and social emotional outcomes yet there are no universally accepted mechanisms to explain this association between family socioeconomic status (SES) and children’s development. Parents with different personal characteristics and life situations use different types and amounts of interactions with their infants. The types and amounts of social interactions infants engage in with their caregivers during their first year of life set the beginning of their trajectories for language and executive control, while also guiding their expectations for social interactions.

This study used previously unpublished data from a sample of 79 young infants, age 3 to 9 months, and their mothers to explore whether associations between SES and parenting interaction behaviors were direct or mediated by mothers’ psychosocial resources and whether associations between psychosocial resources and infant
competence were direct or mediated by parenting interaction behaviors. During a single home visit with each mother and her young infant, infant development was assessed, the mother and infant were observed interacting during a free play session, and mothers reported their education, income, knowledge of child development, and their parenting stress levels. None of the findings directly related to the five hypotheses were statistically significant. However, follow-up analyses provided information about potential future directions for investigating the links between SES, parenting interactions, and infant competencies using smaller categories of education and income levels. These results may guide potential future directions for identifying SES and psychosocial influences on early parenting interaction behaviors and young infants’ early development.

(154 pages)
PUBLIC ABSTRACT

Socioeconomic Status Influence on Mothers’ Interactions with Infants:
Contributions to Early Infant Development

Krista L. Gurko

Children from different socioeconomic backgrounds often have different long-term outcomes in terms of school, language, and emotional wellbeing. At this time, no reasons for these differences have been agreed upon by experts across disciplines. Parents with different personal characteristics and life situations use different types and amounts of interactions with their infants. The social interactions infants experience during their first year of life provide the start of their developmental path in the areas of language and executive control while also guiding their expectations for interactions with people around them.

This study used previously unpublished data from a sample of 79 young infants, age 3 to 9 months, and their mothers. There was a set of five research questions. The first question guided exploration of how socioeconomic status (SES; represented by maternal education and family income) was associated with the parenting behaviors mothers used with their infants. The second question guided exploration of how mothers’ psychosocial resources (represented by child development knowledge and parenting stress) were associated with the parenting behaviors mothers used with their infants. The third question addressed whether associations between maternal education and parenting
behavior were directly connected or if the amount of child development knowledge influenced the association. The fourth question addressed whether associations between family income and parenting behavior were directly connected or if the amount of mothers’ parenting stress influenced the association. The final question addressed whether associations between mothers’ psychosocial parenting resources and infant development were directly connected or if the associations were instead connected by mothers’ psychosocial resources.

During a single home visit with each mother and her young infant, the research visitor assessed infant development, video recorded the mother and infant playing during a free play session, and asked mothers to fill out questionnaires. Project questionnaires addressed mothers’ education and family income as well as their levels of child development knowledge and parenting stress. None of the findings directly related to the five hypotheses were statistically significant. However, follow-up analyses provided information about potential future directions for investigating the links between SES, parenting interactions, and infant competencies using smaller categories of education and income levels. These findings from follow-up questions may guide potential future directions for identifying SES and psychosocial influences on early parenting interaction behaviors and young infants’ early development.
ACKNOWLEDGMENTS

First, I thank those who helped recruit participants for the Home Observation of Parenting and Early Development project and the families who agreed to participate by inviting us into their homes to understand their experience as a parent of a young infant.

Next, I am thankful to my committee members for their encouragement and patience as I developed the ways I listen, think, and write. Doctors Ann Austin, Mark Innocenti, Vonda Jump Norman, Yoon Lee, and Shelley Lindauer each shared their own strengths and passions to ensure this dissertation was of the highest quality. I especially want to thank Doctor Lori Roggman who mentored me personally and professionally in graduate research generally and this dissertation specifically. As I come to the end of my time as a doctoral student, I am fortunate to be standing on the shoulders of these academic giants.

I am thankful for my family — related through blood and love. My mom and dad and my stepmother, Chris, who have always believed in me. My siblings, Amber and Myles, who had the good grace to be born after me and to be my inspiration for studying infants and the parenting experience. My almost-family members, Barbara Stenson and Janeth Trowbridge, who transported me into and through this endeavor over these many years. Each inspired me to study human development and family systems for a range of reasons. Finally, thank goodness for my graduate program colleagues Amy Hill, Tasha Olson, Su Jung Park, and Jae Swainston as well as my supportive friends in other graduate programs, Mercedes Hunt, Terry Kohlmeier, and Rikki Wheatley-Boxx.

Krista L. Gurko
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CHAPTER I
INTRODUCTION

Children from different socioeconomic backgrounds have divergent academic, language, and social emotional outcomes yet there are no universally accepted mechanisms to explain this association between family socioeconomic status (SES) and children’s development (Bradley & Corwyn, 2002; Conger, Conger, & Martin, 2010; Harding, Morris, & Hughes, 2015). Many children have parents who are able to meet their needs, but other children are at risk of not receiving early interpersonal interactions needed for healthy development because parents are not aware of infants’ developmental needs (Lerner & Nightingale, 2016; Suskind et al., 2017b; Weber, Fernald, & Diop, 2017). Although young infants are preverbal, parents’ responsive language and emotional sensitivity provides information infants need to learn about their environment and about themselves as social beings (Lock & Zukow-Goldring, 2010).

The types and amounts of interactions infants engage in during the first 8 months of life set the beginning of their trajectories for language (Kuhl, Conboy, Padden, Nelson, & Pruitt, 2005) and executive control (Clearfield, Stanger, & Jenne, 2015) as well as their expectations for social interactions (Bigelow & Power, 2016; Montirosso, Tronick, Morandi, Ciceri, & Borgatti, 2013). These trajectories and expectations provide the foundation for infants’ first 3 years of life as observed in effects on brain architecture (Noble, Houston, Kan, & Sowell, 2012) and function (Bernier, Calkins, & Bell, 2016). The amount of early interpersonal stimulation infants experience predicts their ease or difficulty managing current and future interpersonal relationships (Baker & Rimm-
Kaufman, 2014; Hedenbro & Rydelius, 2014; H. A. Raikes, Robinson, Bradley, Raikes, & Ayoub, 2007). Parenting is stressful for many parents (Deater-Deckard & Panneton, 2017) but having resources such as experience in formal education and knowledge of infant development (Rowe, 2008; Rowe, Denmark, Harden, & Stapleton, 2016) can increase parents’ competence in adjusting their own behavior to promote infant development (Mermelshtine & Barnes, 2016).

Furthermore, Researchers have identified parenting behaviors that lead to positive infant development (Bowlby, 1969; Phillips & Shonkoff, 2000; Trevarthen, 1979) and long-term child outcomes (Bornstein, Putnick, & Suwalsky, 2017; Bradley, Corwyn, McAdoo, & Garcia Coll, 2001; Bradley, Corwyn, Burchinal, McAdoo, & Garcia Coll, 2001). These include talking with infants to build their language skills and proficiency with social behaviors (Hedenbro & Rydelius, 2014; Rowe, 2012), providing stimulating developmentally appropriate interactions that help structure infant brain development (Copple, 2012; Phillips & Shonkoff, 2000), and engaging in mutually responsive interactions to guide infants to take turns as a respected interaction partner with emerging language and socioemotional skills (Trevarthen, 2001, 2011). Interactions that are rewarding can promote increased engagement (Miller, McDonough, Rosenblum, & Sameroff, 2002).

**Parenting Supports Young Infants’ Development**

Parenting interaction behaviors commonly associated with child competence include affectionate, warm interactions that help infants feel safe and provide the
begins for secure attachment (Bowlby, 1969; Reuben et al., 2016), responses that are contingent on infant actions (DiCarlo, Onwujuba, & Baumgartner, 2014; Gros-Louis, West, & King, 2014; Tamis-Lemonda, Kuchirko, & Song, 2014), support for infant autonomy to explore and persist in difficult tasks with parental guidance (Matte-Gagné, Bernier, & Gagné, 2013; Soska & Adolph, 2014; Tamis-LeMonda, Kuchirko, & Tafuro, 2013), and cognitive stimulation that provides infants with verbal and conceptual information to promote success in their social and physical environments (Banerjee & Tamis-LeMonda, 2007; Ramaekers & Suissa, 2011). These can be called developmental parenting behaviors (Roggman, Boyce, & Innocenti, 2008). Parents with different personal characteristics and life situations use different amounts of these behaviors when interacting with their infants.

Infants develop in ways that match their family environment. Infants of parents who talk frequently and use complex language tend to develop larger vocabularies and have more fluency with literacy-related skills compared with infants of less talkative parents (Hart & Risley, 1995). Infants who experience higher, rather than lower, levels of interaction with more responsive parents tend to have greater competence in social emotional, communication, and cognitive domains (S. H. Landry, Smith, & Swank, 2006). Infants with consistently responsive parents have been found to understand the reciprocal nature of communication and reach language milestones months earlier than infants with inconsistently responsive parents (Tamis-LeMonda, Bornstein, Kahana-Kalman, Baumwell, & Cyphers, 1998).

The amount and types of interactions infants experience provide the beginning of
developmental trajectories that are noticeable by seven months of age in language-related tasks (Betancourt, Brodsky, & Hurt, 2015), executive control tasks of attention (Clearfield & Jedd, 2013), and cognitive flexibility (Clearfield & Niman, 2012). Performance differences often remain stable through early childhood and become more apparent upon entry into childcare or preschool (Rodriguez & Tamis-LeMonda, 2011). Unfortunately, there are often significant differences in developmental trajectories of children in different SES groups (Hoff, 2013).

**Mechanisms Driving Socioeconomic Status Influence**

Researchers call for increased attention to identifying mechanisms driving the impacts of SES on parenting interaction behavior and child development (Duncan, Magnuson, Kalil, & Ziol-Guest, 2012; Duncan, Magnuson, & Votruba-Drzal, 2017; Rowe, 2008; Rowe et al., 2016). However, researchers in different fields use different approaches to (a) defining SES and (b) gauging the benefits of keeping SES indicators separate, making a composite measure (Ursache & Noble, 2016), or comparing a combination of those approaches (Azad, Blacher, & Marcoulides, 2014) challenging. Despite lack of consensus about which specific SES indicator(s) are most influential at what developmental levels, SES is consistently identified as a factor influencing child development outcomes. These indicators merit further investigation (Bradley & Corwyn, 2002; Pace, Luo, Hirsh-Pasek, & Golinkoff, 2017).

Combining family SES indicators (e.g., income, education, occupation) into a composite measure provides a broad picture of SES influence on parenting and child
outcomes (Bornstein & Bradley, 2003; Duncan & Rodgers, 1988; Letourneau, Duffett-Leger, Levac, Watson, & Young-Morris, 2011). When a composite measure demonstrates meaningful findings, however, further analyses are often needed to determine which SES indicator was responsible and more accurately identifying specific mechanisms (Hackman, Gallop, Evans, & Farah, 2015). Two SES indicators investigated separately have been consistently associated with early childhood development trajectories: maternal education (Harding et al., 2015; Rowe, 2008; Rowe, Pan, & Ayoub, 2005) and family income (Duncan et al., 2017; Finegood & Blair, 2017; Hart & Risley, 1995, 2003).

Formal education, measured by years of a person’s life spent in school, indicates the amount of exposure to information and school systems as well as the individual’s persistence in pursuing school to different levels of completion. High school graduation is a commonly used demarcation line between lower versus higher levels of education. If individuals have a child, the focus expands beyond their own life opportunities to address their children’s immediate and long-term experiences (Harding et al., 2015). Researchers may focus on behaviors of parents who drop out of high school (Burchinal, Vernon-Feagans, Cox, & Key Family Life Project Investigators, 2008) or those parents who attend at least some college (Kalil, Ryan, & Corey, 2012; Shah, Sobotka, Chen, & Msall, 2015). Parents with higher levels of education tend to spend a greater percentage of time in developmentally appropriate interactions such as play compared with parents with lower levels of education (Kalil et al., 2012). More education tends to be associated with greater flexibility in parent expectations for their child as learner as well as a wider
variety of skills to adapt to their infant’s behaviors. Additionally, increased education can improve parent awareness of how to find and apply information to increase their opportunities and can increase access to higher paying employment (Harding et al., 2015).

Researchers use a variety of income ranges to indicate a critical level of family disadvantage. Some use the federal poverty line (Betancourt et al., 2015; Noble, Norman, & Farah, 2005), others posit that children living in families within 100-200% of the federal poverty guideline experience similar detrimental impacts as families under the 100% of the federal poverty guideline (Blair et al., 2011; Duncan et al., 2017; Gershoff, Aber, Raver, & Lennon, 2007; Suskind et al., 2017b). Family income is an indication of resources available to the family and the degree of economic security the members are likely to experience consistently and in the face of hardship. Families with more income are likely to be in safer neighborhoods and to be able to afford the necessities of caring for an infant with less strain than families with less income (Harding et al., 2015). Parents experiencing a low-income spell may have fewer tangible resources to invest in their infants (Duncan et al., 2017) and may have increased stress levels (Vernon-Feagans et al., 2008). Parents with less income are less likely to engage in interactions such as reading, singing, or going on an outing with their infants, which can lead to developmental delays (Shah et al., 2015).

**Psychosocial Resources, Parenting, and Early Infant Development**

Each mother has her own psychosocial resources she draws upon when she
performs her parenting responsibilities. Psychosocial resources are influenced by mother’s own attributes, for instance education attainment, and the family context she parents within, for instance family income status. Some psychosocial resources are considered beneficial in greater amounts; for instance, a mother’s knowledge of child development (Bornstein et al., 2017). Other psychosocial resources are considered beneficial in lower amounts; for instance, parenting stress (Abidin, 1990; Garner et al., 2012).

Developmental knowledge includes a parent’s level of knowledge about infant development milestones and timing (Bornstein, Cote, Haynes, Hahn, & Park, 2010; Suskind et al., 2017a). Accurate developmental knowledge can lead a parent to use developmentally supportive behaviors (Damast, Tamis-LeMonda, & Bornstein, 1996). Limited or inaccurate developmental knowledge can lead a parent to underestimate infant abilities and therefore not offer adequate levels of parenting infants need to thrive (Gadsden, Ford, & Briener, 2016; Lerner & Nightingale, 2016; Lindsay & Strand, 2013; Reichle, Backes, & Dette-Hagenmeyer, 2012). Lack of developmental knowledge can lead parents to overestimate infant abilities and expect too much of their infants too soon, leading to increased stress for parents and infants (Tamis-LeMonda, Shannon, & Spellmann, 2002). While some parents intuitively follow their infant’s lead during interactions (Papoušek & Papoušek, 1995), many parents lacking child development knowledge may not realize that younger infants are capable of learning and that parents are important influences on their development (Leffel & Suskind, 2013).

Parenting stress can interfere with parents’ ability to be sensitive or responsive to
infant needs. Parents who are stressed may not notice subtle infant behaviors or may not be able to respond appropriately if they do notice (Webster-Stratton, 1990), which can cause infants to become less emotionally regulated (Williford, Calkins, & Keane, 2007), and less able to develop later skills for coping with challenges and interacting with peers (Begle, Dumas, & Hanson., 2010; Sparks, Hunter, Backman, Morgan, & Ross, 2012). Stress from the responsibilities of parenting may present a barrier to providing developmentally supportive interactions due to its common manifestation as negative feelings the mother has about herself and her child(ren) (Deater-Deckard, 1998).

The importance of interactions in the first eight months of infancy has gained attention across disciplines as more researchers study younger infants (Banerjee & Tamis-LeMonda, 2007; Bigelow & Power, 2016; Kuhl et al., 2005; Mireault et al., 2014). However, many longitudinal population-level studies of parents with infants did not collect information on parenting interactions and infant development before the beginning of the infants’ second year of life. These population-based studies, most of which focused on high-risk older infants, leave gaps in current understanding about low-risk younger infants and their parent-interaction experiences (Garrett-Peters et al., 2008; Nord, Edwards, Andreassen, Green, & Wallner-Allen, 2006; Taylor, Dearing, & McCartney, 2004).

**Purpose of the Study**

This study used information from a previously unpublished sample of young infants and their mothers to explore whether links between SES and parenting interaction
behaviors were direct or mediated by mothers’ psychosocial resources. It also aimed to fill a recently identified gap in the literature (Rowe et al., 2016) by assessing whether links between mothers’ psychosocial resources and infant competence were mediated by parenting interaction behaviors. Additionally, this study extended previous research by presenting findings from a project that expanded an existing parent-child interaction measure for use observing parents with younger infants than the original measure. It also separated two socioeconomic indicators to better understand whether income or education have a greater association with parenting behaviors for mothers of young infants, and whether any associations of parenting or child development with either SES indicator were mediated by mothers’ psychosocial resources.

Compared to older infants, the association between parenting interaction behaviors and infant competence may be different for infants in the first year. The 2017 Home Observation of Parenting and Early Development (HOPED) project data offered an opportunity to study a low-risk sample of young infants and their highly educated mothers in families across a range of income levels to determine how different SES indicators compared in terms of mother psychosocial resources and whether these resources were associated with parenting interaction behaviors and infant competence.

**Research Questions**

1. Do mothers with higher socioeconomic status, reflected in maternal education and family income, interact more supportively with their infants?

2. Do mothers with more parenting resources, reflected in more developmental
knowledge and less parenting stress, interact more supportively with their young infants?

3. Does mothers’ developmental knowledge mediate any of the association between maternal education and supportive interaction behaviors with their young infants?

4. Does mothers’ parenting stress mediate any of the association between family income and supportive interaction behaviors with their young infants?

5. Do mothers’ supportive interaction behaviors mediate any of the associations between mothers’ parenting resources and their infants’ developmental competence?
CHAPTER II
REVIEW OF THE LITERATURE

This study explored socioeconomic and parenting resources as predictors of mother-infant interactions in relation to early infant development. The purpose of this literature review is to: (a) provide the theoretical foundation for the study; (b) identify specific parenting behaviors that support early development; (c) summarize research literature about SES, indicated by education and income, in relation to mother psychosocial resources and parenting interaction behaviors; and (d) examine how these parenting behaviors and thus infant development may be influenced by SES and parent psychosocial resources, as reflected by developmental knowledge and parenting stress. Lev Vygotsky’s (1978) sociocultural theory and Arnold Sameroff’s (1975, 2009) transactional model provided a framework for exploring socioeconomic and psychosocial resource factors that may mothers draw upon as they guide infant development.

Theoretical Foundation

Vygotsky’s Sociocultural Theory

Vygotsky (1978) posited that child development stems from an integration of biology and sociocultural experiences. Biology provides characteristics and skills a child has at birth or gains through maturation while social interactions with adults guide the development of infants’ skills and behaviors within their environment. During interactions with more experienced people such as their mothers, infants become aware of and prepare to use cultural tools such as language, social behaviors, and the culturally
valued knowledge it is important for them to acquire. Interactions help infants gain a
sense of self and how they fit their family and cultural context. Young infants depend on
others in their environment to identify infant needs and to adjust interaction behaviors to
support culturally appropriate infant development.

Both parent and child devote attention to each other within these interactions even
though they may have different goals. Infants cannot consciously change their behavior,
but mothers can guide infant development by offering support without being
overwhelming (Miller et al., 2002). Individuals do not need to be aware of their role in
the interaction as guide or learner for those functions to be filled (Rogoff & Wertsch,
1984), but adults who view themselves as guides may make different decisions compared
to those who do not.

Mothers use various guiding strategies during their interactions. One example of a
strategy is scaffolding, or providing targeted support for infant learning at a slightly more
advanced level of functioning than the infant would be able to achieve independently
(Wood, Bruner, & Ross, 1976). Mothers can choose to accept infant’s behavioral efforts
even when actual performance is an incomplete or imperfect approximation of the correct
form. Alternatively, mothers can adjust their expectations to their infant’s current ability
level by modifying the task or increasing the time they wait for infants to act (Landry,
Garner, Swank, & Baldwin, 1996). Infants with a mother who scaffolds their learning in
these ways can more efficiently achieve skills and knowledge for participating in the
family and community culture compared with infants without this developmental
guidance (Hodapp, Goldfield, & Boyatzis, 1984; Shotter, 1993).
Sameroff’s Transactional Model

Sameroff’s (1975, 2009) transactional model extends Vygotsky’s sociocultural theory by describing the mechanism by which humans develop in the context of their interactions. Individuals, with their unique characteristics and expectations, engage in interactions that modify both partners and their expectations for the relationship. Healthy infant development depends on the mother and other family members to be responsive to infant needs and to allow the infant to influence caregivers to change the environment rather than demanding that the infant conform to rigid expectations (Sameroff, 2009). Interactions are considered transactional only when each individual can influence the other within their shared context (Fiese & Sameroff, 1989; Sameroff, 2009). For example, some infant behaviors are triggers for mothers to identify infant developmental progression, which will then change the set of experiences the mother makes available to the infant (Sameroff, 2009). In turn, as early as four months, infants develop behaviors to coordinate with adult interactions, such as increasing or decreasing amount of eye contact or vocalizations (Beebe et al., 2010). Infants prefer to interact with adults who provide contingent responses (Bigelow, 1998; Bigelow & Birch, 1999). Repeated experiences within these transactions help organize infant behaviors into patterns that continually influence development over time.

Transactions between mother and infant begin with an early task of the infant maintaining physiological regulation (Sameroff, 2010). Facilitating optimal regulation is one way the mother supports infant development within the family context (Fiese & Sameroff, 1989). Mothers can use their own behaviors to maintain, reduce, or amplify
infant behaviors (Sameroff & MacKenzie, 2003) to help infants become more physiologically regulated and ready to actively participate in interactions (Sameroff, 2010). Mothers who do not know that they affect early infant development may be less likely to respond to infant needs contingently, consistently, or sensitively (Donovan, Taylor, & Leavitt, 2007). Mothers who experience too much parenting stress may find it difficult to respond even if they have child development knowledge (Kim, Capistrano, & Congleton, 2016). Infants without responsive developmental support will be more likely to show early language delays (Rollins, 2003) and behavior problems (Belsky, Hsieh, & Crnic, 1998) that may interfere with later school success (Sektnan, McClelland, Acock, & Morrison, 2010).

**Infant Development and Mother-Infant Interaction**

Young infants are wholly dependent on caregivers, often mothers, to provide a safe, stimulating environment with responsive, developmentally supportive interactions. Within the mother-infant dyad, infants learn interaction practices that provide the foundation for learning about themselves, expectations for interpersonal communication, and using tools in their environment. In addition to their basic needs for health and safety, infants depend on the stimulation and information gained from interpersonal and parent-supported interactions as they learn how to identify patterns within the content and timing of communication. Infants use the information to accumulate knowledge for later use, such as with phonetic and syntax characteristics of language (Saffran, Aslin, & Newport, 1996; Saffran & Kirkham, 2018) or to anticipate what to expect and how to respond
during future interactions (Markova & Legerstee, 2006). While infants are born ready to interact with people (Meltzoff & Moore, 1983), their potential for learning expands rapidly in the first few months of life due to a mix of maturation and affective responses to social interactions with caregivers (Markova & Legerstee, 2006). Infants learn from their caregivers’ response, or lack of response, whether their actions cause effects that provide increased control over their own environment. By two or three months of age, infants begin to develop expectations about the level and type of interactions they typically have with their mother and adjust their behavior accordingly (Henning & Striano, 2011). Without experiencing consistent, contingent parenting responses to guide them, infants may feel less safe and secure (Millar & Watson, 1979) and may take more time to learn how to connect language with concepts and objects in the environment (Tamis-LeMonda et al., 2013).

Information learned by infants accumulates when they access experiences in the surrounding environment and have communication directed specifically to them (Rowe, 2008). Infants younger than 3 months of age generally orient toward information that catches their attention perceptually whereas infants between 4 and 6 months learn to hone their skills of ignoring superfluous information and instead devoting their focus on relevant information (Amso & Scerif, 2015). Infants use information accumulated through their interactions to unconsciously calculate probabilities of what behaviors and information are important to learn for their improved communication (Denison, Reed, & Xu, 2013; Meltzoff, Kuhl, Movellan, & Sejnowski, 2009; Saffran et al., 1996). Using those calculations supports development of increasingly efficient behaviors and responses
that help infants preserve their energy by avoiding ineffective strategies to get their needs met within their particular sociocultural environment (Chang, de Barbaro, & Deak, 2016). Accumulated information builds into developmental trajectories that match the culture of the family and other environments where the infant spends time.

Developmental trajectories are often associated with socioeconomic status, as measured by maternal education (Clearfield & Jedd, 2013), family income (Rodriguez & Tamis-LeMonda, 2011), or both (Betancourt et al., 2016; Clearfield et al., 2015).

Mothers from various backgrounds provide their infants with different experiences across the first months of life. Infants are not able to access these experiences on their own due to mobility and communication limitations. Mothers who provide new experiences, consistent routines, and reliable responses guide infants about what information to devote attention to and retain in their growing set of skills and knowledge (Tummeltshammer, Wu, Sobel, & Kirkham, 2014). However, mothers who are consistently unaware of infant interaction bids, who interpret infant cues inaccurately, or who do not provide appropriate and prompt responses may impede infant ability to maintain regulation states and anticipate interaction events (Beebe & Steele, 2013).

Caregiving responsibilities include supporting quickly changing infant abilities while also providing soothing responses to infant cries (Rogoff, Malkin, & Gilbride, 1984). Infants interact with varying levels and sequences of complexity as their cognitive, motor, and neural systems develop (Adolph, 2002). New abilities appear from both maturation and learning by interacting with people and objects in the environment (Bornstein, Hahn, & Suwalsky, 2013; Kovach-Lesh, McMurray, & Oakes, 2014).
Mothers may find it easy or challenging to consistently support their infants when infant abilities progress rapidly and do not seem to follow a uniform, predictable pattern (Molfese et al., 2010). Mothers’ investment of time and attention influence the growing relationship while also contributing to infant development.

Mothers have different perspectives on their experience as a cultural guide, with some reporting their responsibility of parenting an infant as easy and joyful contrasted with others reporting that parenting is boring, stressful (Nelson, Kushlev, & Lyubomirsky, 2014), and for many, fatiguing due to managing child care and household responsibilities (Cooklin, Giallo, & Rose, 2011; Musick, Meier, & Flood, 2016). Mother personality and infant temperament influence the relationship needs of each partner in a transactional manner. Mothers who experience stress and have lower self-efficacy may have fewer psychosocial resources to respond sensitively to infant needs (Kim et al., 2016). Infants who are highly reactive may require higher quantities and increased intensity of sensitive interactions to become physiologically regulated enough to positively engage in interactions (Pratt, Singer, Kanat-Maymon, & Feldman, 2015).

Mothers who create stability for their infants, even with few financial resources or while experiencing difficult situations, may have coping strategies to keep themselves calm or may themselves have greater competency with working memory, inhibitory control, and other executive function attributes (Sturge-Apple, Jones, & Suor, 2017). Social support can also help strengthen mothers’ resilience and persistence in providing sensitive care whether they are poor (Morris et al., 2017), single (Z. E. Taylor & Conger, 2017), or partnered (Bean, Softas-Nall, Eberle, & Paul, 2016). Mothers’ beliefs about
infant development also influence their parenting decisions. Mothers who trust that the infant’s natural organismic development will occur normally as long as they keep the infant safe from harm and near family are less likely to drastically adapt their interaction style to accommodate the infant (R. Landry et al., 2008). Through many interactions over time, infant and mother develop together, adjusting to each other to a large or a small degree.

**Developmental Parenting**

Parenting behaviors associated with positive infant development outcomes include warmth, responsiveness, encouragement, and cognitive stimulation, together considered aspects of developmental parenting (Roggman, Cook, Innocenti, Jump Norman, & Christiansen, 2013a). Mothers can adapt their behaviors to infants’ current developmental level while also laying the foundation for upcoming development (Cook, Roggman, & D’Zatko, 2012). When infants have a mother who engages positively and responsively, while providing encouragement to explore and stimulation for learning, the mutual interactions set the foundation for infants’ current and later learning (Sorce, Emde, Campos, & Klinnert, 1985). Mothers’ own values and understanding of how infants develop may influence how comfortable they are in using different types of interactions.

**Affection**

Affection, or warmth, indicates how comfortable a mother feels as she interacts with her infant (Reuben et al., 2016). Affection provides a sense that the mother enjoys
being with the infant. Body language includes smiling at the infant and keeping an infant in close proximity to her own body. Verbally, a mother may show warmth through affectionate words or praising infant efforts. Young infants can respond to their mothers in subtle ways by curling into their mother or returning smiles.

Infants who experience warm interactions with an emotionally available mother have lower stress levels throughout childhood (Philbrook et al., 2014). They also have improved behavior regulation (Belsky, Woodworth, & Crnic, 1996; Reuben et al., 2016) and greater academic achievement and school readiness skills (Watkins-Lewis & Hamre, 2012). Infants benefit from a warm parenting style, yet mothers vary in levels of warmth, depending on their personal characteristics and life situation (Crnic, Gaze, & Hoffman, 2005).

High levels of maternal warmth are associated with improved executive control and self-regulation in infancy, often continuing into middle childhood (Colman, Hardy, Albert, Raffaelli, & Crockett, 2006). Warm parenting can help buffer infants from the effects of impoverished and stressful environments that would otherwise interfere with cognitive development (Watkins-Lewis & Hamre, 2012) or long term physical health (Belsky, Bell, Bradley, Stallard, & Stewart-Brown, 2007). Mothers who provide warmth and affection—smiling and enjoying closeness—help infants feel safe, supported, and nurtured (Choe, Olson, & Sameroff, 2013).

Mothers have different reasons for showing low warmth or even harshness in their parenting practices. Caring for an infant is stressful and intense for some mothers. Mothers may not feel prepared to meet the constant physical and emotional caregiving
demands (Nyström & Öhrling, 2004). Mothers may experience stress related to the financial responsibilities of parenthood (Lee, 2013; Pereira, Negrao, Soares, & Mesman, 2015; Zalewski et al., 2012). Mothers may also be unhappy about how parenting responsibilities take time away from other interpersonal relationships (Hajal et al., 2015). Mothers with negative perceptions of their infant’s interaction styles or personal characteristics may have more difficulty showing warmth toward the infant (Wang, Deater-Deckard, & Bell, 2013). Lack of developmental knowledge about infant emotional needs can interfere with mothers taking the time and energy to provide warm parenting (Nutall, Valentino, Wang, Lefever, & Burkowski, 2015). In addition to these potential barriers to providing warmth, mothers of young infants may be learning to balance their own needs with learning how to read and respond appropriately to infant cues.

**Responsiveness**

Responsiveness, or contingency, indicates that a mother notices infant behavior and reacts in some observable way (DiCarlo et al., 2014; Gros-Louis et al., 2014; Tamis-Lemonda et al., 2014). Mothers of young infants may need to look closely and use multiple senses to increase awareness of infant cues. Potential infant interaction cues can appear in many forms, for instance, spontaneous vocalizing, burping, clasping hands over his or her chest, or making or breaking eye contact. Mother responses can also be in many forms, such as imitation, describing actions, providing something the infant wants, or pausing her interaction (Bornstein, Tamis-LeMonda, Hahn, & Haynes, 2008). Contingent responses are directly related to infant actions and bids for attention. By
following no more than a few seconds after the infant’s action, the response supports ongoing communication (Harder, Lange, Hansen, Vaever, & Koppe, 2015; Tamis-LeMonda et al., 2013). Mothers can gain their infant’s attention by responding to infant intentional and unintentional actions (Kaye, 1979). After repeated experiences of being responded to, infants begin to intentionally make actions to engage their mother and others in play.

Infants with mothers who respond with high levels of contingency increase their engagement with objects and people, often showing faster development at earlier ages (S. H. Landry et al., 2006). These infants also show less negativity, have better expressive language, and more complex play compared with infants with less responsive mothers (Guttentag et al., 2014). During time together, the two communication partners learn to read each other and adjust their behavior according to each other’s responses in a bidirectional (Hummel, Kiel, & Zvirblyte, 2016) or intersubjective (Trevarthen, 1979, 2001) manner. Each partner can influence the flow of communication to create greater or reduced levels of interaction. Infants as young as two months old can have beginning awareness that they are part of a social relationship, showing more social bids to mothers who were more responsive in previous interactions (Bigelow & Power, 2016). If given the opportunity, 4-month-old infants will often insert their own vocalizations between mothers’ pauses, establishing a pattern of turntaking by reducing the number of their vocalizations that occur at the same time as mothers’ (Harder et al., 2015). Without consistent responses from a communication partner, many infants reduce rather than increase their vocalizations between 4 to 7 months of age (Harder et al., 2015).
Mothers who sensitively respond to an infant’s cues for interaction show that they value infant needs and can often offer support before an infant becomes frustrated or misses a learning opportunity. When mothers read negative infant cues and alter their own behavior to positively re-engage the infant, they increase the opportunity for infant learning and build trust within the relationship (Tronick, 1989). Responsive mothers help guide infants to communicate more often, in more diverse ways (DiCarlo et al., 2014), and are more likely to use language to describe the environment and support infant exploration rather than to control infant behavior (Tamis-LeMonda et al., 2013).

Mothers have different reasons for being less responsive in their parenting practices. They might not realize how important they and their interactions are to the infant’s development (Austin et al., 2006). Alternatively, they may not consider each young infant an individual with unique needs and whose optimal development depends on caregivers to quickly identify and meet their needs (Guttentag et al., 2014). Mothers with little experience interacting with infants may not know how to read subtle infant cues for interaction that are present from birth (Beebee et al., 2010; Rogoff et al., 1984). They also may not realize that infants depend on caregivers to notice their cues and respond consistently and contingently from birth (Bornstein et al., 2008). One example of a parenting intervention aimed to increase mothers’ sensitivity to young children was the Early Head Start (EHS; Love et al., 2002) evaluation. Study outcomes showed that program impacts on children were mediated by program impacts on parenting sensitivity and supportiveness (Love et al., 2002; H. H. Raikes et al., 2014). Parents who received EHS resources and training were better able to manage their own feelings, to protect
infants and toddlers from difficult family situations, and to provide more developmentally appropriate parenting interactions.

**Encouragement**

Encouragement, or autonomy support, indicates how a mother actively supports an infant in following his or her own interests and goals (Matte-Gagné et al., 2013; Soska & Adolph, 2014; Tamis-LeMonda et al., 2013). Mothers who observe while their infant leads the interaction enables identification of changes in the level of the infant’s engagement with her or with objects in the environment. When the infant is intensely engaged, mothers can be a witness to infants’ learning and provide subtle verbal or physical supports to expand the infant’s abilities without redirecting the activity. When infants are less intensively engaged mothers can offer options for maintaining the infants’ attention in the same general activity.

Infants who have opportunities to follow their own interests during exploration often have greater physical and cognitive growth compared to infants without those opportunities (Clearfield, Bailey, Jenne, Stanger, & Tacke, 2015). Mothers who imitate infants’ sounds and actions show infants they have an effect on their environment. Imitation can also alert infants to new experiences and opportunities for interaction, prompting increased engagement with their environment (Roorbach Jamison, Cabell, LoCasale-Crouch, Hamre, & Pianta, 2014). Supporting infants in following their own interests builds their motivation (Whipple, Bernier, & Mageau, 2011) as well as their confidence to learn new things and complete challenging tasks (Clearfield & Niman, 2012; Deci, Nezlek, & Sheinman, 1981). Infants who are not encouraged to follow their
own interests are more likely to become toddlers and preschoolers with behavior challenges that interfere with learning (Belsky et al., 1996) and may grow to view themselves as being less socially acceptable (Kochanska, 2002).

Mothers who support infants’ needs for exploration promote self-confidence, persistence, and motivation (Whipple et al., 2011). Mothers’ encouraging behaviors take a variety of forms including providing modeling, offering physical support gauged to the infant’s level of ability, or waiting for the infant to exhaust his or her own resources in trying to achieve a goal before offering suggestions (R. Landry et al., 2008).

Encouragement can also help build infants’ attention spans when mothers notice what infants are looking at and join the infant by providing information and support for shared appreciation of the object (Findji, 1993). Mothers can also encourage development of joint attention by noticing when the infant joins the mother by looking at the same object (Perra & Gattis, 2012). This approach to supporting infant development takes more time and effort from mothers compared to completing tasks for the infant.

Rather than showing encouragement by following their infants’ lead, some mothers are more comfortable controlling their infants’ schedule and movements. Mothers who have multiple children or hold roles in addition to parenting may feel they need to keep a strict schedule to meet their responsibilities (Carney-Crompton & Tan, 2002). They may have less energy to notice or to follow infants’ interests or bids for interaction (Deater-Deckard & Panneton, 2017). Mothers may feel that teaching their infants to follow directions is an important way to keep them safe (Erwin & Brown, 2003) and compliant (Gershoff, 2002). Mothers who are concerned about their parenting
responsibilities may feel more comfortable controlling interactions rather than being flexible (Zhang, Cui, Han, & Yan, 2017).

**Cognitive Stimulation**

Cognitive stimulation, or teaching, indicates how a mother shares knowledge about the world. Mothers use multiple modes of sharing information such as visually showing (Feron, Gentaz, & Streri, 2006) or verbally providing labels and descriptions for objects and actions (Banerjee & Tamis-LeMonda, 2007; Ramaekers & Suissa, 2011). Although infants learn through every interaction, cognitive stimulation indicates specific times when a mother actively engages with her infant to provide information. Mothers who use speech directed toward infants as if the infants understand the content provide clear guidance for infants regarding what information is important to know and how to communicate that information (Rowe, 2008).

Preverbal infants as young as 6 months of age may not understand the words being spoken, but with enough exposure to infant-attuned conversation, they are able to engage in back and forth interactions by identifying logical breaks in speech (Soderstrom, Seidle, Kemler Nelson, & Jusczyk, 2003). Early child-directed conversation is associated with later vocabulary size, especially when comprised of complex language and longer utterances rather than simple statements that direct the child’s interactions (Hart & Risley, 1995; Rowe, 2008). Mothers who notice infant engagement can begin to build meaning into the infant’s side of the interaction, a transactional practice that encourages infants to increasingly engage in parent-mediated learning of verbal and related socially acceptable skills (Goldstein, Schwade, Briesch, & Syal, 2010).
When mothers provide cognitive stimulation, infants expand their repertoire of experiences and their attention span so they can learn about the world more efficiently and effectively (Tamis-LeMonda & Bornstein, 1989). Repetition and routines help infants become familiar with objects and people who can then expand their experience (Rączaszek-Leonardi, Nomikou, & Rohlfing, 2013). Infants categorize the information they learn and they benefit from stimulation provided when they are rested and actively alert (Rader & Zukow-Goldring, 2012).

Mothers help infants learn about the world by sharing information about social practices, objects, and other occurrences the infant might notice. Mothers use many strategies for gaining and keeping infant attention, often adjusting their interaction behaviors to match infants’ developmental progression (Adamson & Bakeman, 1984; de Barbaro, Johnson, Forster, & Deak, 2016). When infants are engaged in interactions, mothers who vary voice, gesture, and physical motion with objects can help the infant focus on what the mother wants to teach (Adamson, Bakeman, & Brandon, 2015; Coventry et al., 2010).

The different types and amounts of cognitive stimulation provide information associated with different infant developmental trajectories. Infants with mothers who do not talk to them or include them in daily activities, compared with infants who are talked to and included, have fewer opportunities to gather information needed to construct an understanding of themselves in the world or to communicate their needs (Bahrick, Lickliter, & Flom, 2014; de Barbaro, F2016; Hart & Risley, 1995, & 2003). New technological advances enable expanding research into the effects of mother-infant
interactions on infant neurological functioning. Effects of differences in parenting qualities are reflected in neurological observations of infant competence in the first few months of life, showing that for infants 5-10 months old, processing power was higher and increased more rapidly if parents showed more positive affect and less intrusive interactions (Bernier et al., 2016). In this same sample, infants of parents who showed more positive affect during an infant-parent interaction task had greater visual attention competency compared with parents who were more intrusive during this same task (Swingler, Perry, Calkins, & Bell, 2017). In another study, increased or reduced maternal mirroring of infant positive facial expressions at 2 months of age predicted infant level of neurological processing of infant motor movements in response to maternal facial expressions at infant age 9 months (Rayson, Bonaiuto, Ferrari, & Murray, 2017).

Many early interaction experiences predict later infant competence. In one study, infants with mothers who more frequently supported increased duration of infant attention at five months of age had greater language comprehension and representational competence at 13 months of age compared to infants with mothers who did not previously encourage longer infant attention (Tamis-LeMonda & Bornstein, 1989). Another study found that infants of mothers with higher extraversion and more parenting stress took a shorter time to look away from an object at four months of age and later displayed less effortful control when measured at 12 and 18 months of age (Gartstein, Bridgett, Young, Panksepp, & Power, 2013).

The active and passive choices mothers make in interacting with their young infants provide the foundational experiences for infants to build on throughout their lives.
The types of parenting behaviors that mothers use with their infants depend upon their values, beliefs, and resources (Rowe et al., 2016) as well as the unique characteristics and interests of the infant. Some parents may benefit from parenting education or training that provides clearly stated interaction goals between parents and infants (Suskind et al., 2017b). For other parents, interventions may be most helpful when addressing unique family and parenting stresses (Moreland, Felton, Hanson, Jackson, & Dumas, 2016). One study of young, high-risk young mothers found that compared to mothers who provided few interactions, mothers who were intrusive promoted greater infant development gains (McFadden & Tamis-LeMonda, 2013). Affirming the mother-infant relationship and ensuring mothers are aware of infant needs and capabilities can support mothers in balancing their many responsibilities and leaving energy for responsive parenting (Brophy-Herb et al., 2009).

The previous sections addressed transactional processes of cultural transmission, parenting approaches mothers can use to guide infant development, and common interactions for mothers and young infants. Early infancy is a unique time when infants are beginning to establish their role and how they can best get their needs met within the family context. The following section investigates potential resources and barriers for mothers’ interactions with their infants. Socioeconomic status, a marker for social resources and opportunities, is widely studied in connection to parenting practices, especially regarding low-income or impoverished families. Following a brief overview of the role of SES in parenting and child development, the review focuses on maternal education and family income (Ayoub, Valloton, & Mastergeorge, 2011; DeGarmo,
Socioeconomic Status and Psychosocial Resources

It is widely accepted that SES predicts parenting and child development outcomes in the U.S., yet there are few certainties about the underlying mechanisms (Bradley & Corwyn, 2002; Harding et al., 2015; Krieger, Williams, & Moss, 1997; Sturge-Apple et al., 2016; Turkheimer, Haley, Waldron, d’Onofrio, & Gottesman, 2003). Socioeconomic status represents a family’s economic and social position in relation to other families. Three indicators, used separately or in combination, determine SES level: parent(s) education attainment, family income, and parent(s) occupation (Bornstein & Bradley, 2003). Many SES indicators and their associated outcomes are multifaceted and have few consistent guidelines for separating complex relationships into manageable parts across disciplines (Ursache & Noble, 2016).

Infants from families with different levels of SES tend to have different developmental trajectories that are observable in the first months of life (Fernald, Marchman, & Weisleder, 2013) and become more noticeable upon entering the school system (Rodriguez & Tamis-LeMonda, 2011). SES is often passed through generations such that grown children will likely have similar life options and similar outcomes as their parents (Duncan et al., 2017). Children who begin in the lowest trajectory of functioning may never reach the same level of functioning as their peers from higher SES families (Feinstein, 2003). Mothers in lower SES families tend to provide for their children’s basic needs, valuing extended family and children’s freedom to develop
naturally on their own rather than inside of a larger social structure such as school or community (Lareau, 2002, 2011). Middle SES parents tend to value education and expanding children’s access to extracurricular activities that provide children with non-familial adult social models (Lareau, 2002, 2011). Mothers in middle SES families often have more social capital to access education and knowledge of educational norms compared to mothers from lower SES families (Lareau & Weininger, 2003), but they have less compared with mothers in higher SES families (Lareau, Aida Evans, & Yee, 2016). Mothers’ values can often be observed in parenting behaviors and choices they make for their children. The choices are not always within the mothers’ conscious awareness even though they likely inform mothers’ maintenance of family interactions and support for infant regulation.

Although maternal education and family income are often used interchangeably and in combination to represent SES, they operate differently and may relate to parenting and child development in different ways. Similarly, lack of child development knowledge and the presence of parenting stress are both psychosocial barriers to parenting interactions that are separate and may relate to parenting behaviors and child development in different ways. Given the current economy where obtaining high levels of education is costly and does not always lead to highly paid employment, parents with undergraduate or graduate degrees may choose to stay home with their children rather than taking a job that does not pay well. Alternative employment options that allow work outside of an office have led to widespread opportunities for increasingly flexible work schedules that often require employees to advocate for themselves rather than being able
to depend on longer-term commitments from employers (Spreitzer, Cameron, & Garrett, 2017). People with more valued skills are better able to compete in the workforce, leaving those who are less skilled at a disadvantage. One study found that in addition to skill level, gender may also put alternative employees at a compensation disadvantage with women paid an average of 70% of men’s hourly rate for each hour worked in every job category (Barzilay & Ben-David, 2017). This creates a research climate where it is increasingly important to explore potential mechanisms to explain how maternal education and family income relate to parenting psychosocial resources and child development.

**Maternal Education**

A mother’s education level influences life opportunities available for herself and her children (Harding, 2015; Pressler, Raver, & Masucci, 2016). Experience with higher education provides mothers with skills of talking with professionals for information, comfort with reading to find information, and more organized thinking (Ribas, Moura, & Bornstein, 2003) that prepare them to effectively invest in preparing their infants for later school success (Lareau et al., 2016). More highly educated mothers tend to spend more time interacting with their infants using developmentally appropriate activities (Kalil et al., 2012), more complex infant-directed speech (Rowe et al., 2005), and more enriching home learning environments with more books and learning materials (Magnuson, Sexton, Davis-Kean, & Huston, 2009). These mothers, often more confident in their mothering decisions, are likely to use more developmentally supportive interactions and more successfully read infant cues (Benasich & Brooks-Gunn, 1996; Rutherford, Maupin,
Landi, Potenza, & Mayes, 2017). They are more likely to scaffold infant learning (Rodriguez & Tamis-LeMonda, 2011), to use more positive affect, and to be less intrusive (Bernier et al., 2016).

Children of mothers with less education consistently have developmental competency trajectories that lag behind children of mothers with more education; this has been observed at 18 and 24 months (Fernald et al., 2013), 5 years (Raizada, Richards, Meltzoff, & Kuhl, 2008), and adulthood (Ursache & Noble, 2016). Lags in early language, often associated with amount and quality of language infants hear at home, tend to continue over time (Hart & Risley, 1995; Hoff, 2013; Hoff-Ginsberg, 1991). In one study, differences in infant 12-month language scores predicted similar differences in 36-month IQ scores (Benasich & Brooks-Gunn, 1996). In another study, infants from two different SES groups showed a 6-month competency difference when tested on vocabulary at 18 months (Fernald et al., 2013). The two groups maintained the 6-month differences when assessed again at 24 months, showing that their divergent developmental trajectories were stable. These, similar to other studies, measured family SES indicators but not mothers’ developmental knowledge that may be more closely associated with maternal education than family income.

**Family Income**

Families with different income levels have different financial resources to spend and different levels of general stress to manage. Family income, a primary indicator of SES, has become increasingly common for identifying family risk (Conger et al., 2010; Duncan et al., 2017). Income amount is frequently used when discussing a family’s
financial resources (Evans & Rosenbaum, 2008). Alternatively, family income-to-needs ratio can be determined by dividing family income by the number of people in the household and comparing the answer with the U.S. Census Bureau federal poverty guidelines. Identification of families as experiencing lower or higher levels of income indicates the types and amounts of resources they are likely to have available for meeting their family needs (Betancourt et al., 2016). Child poverty is a persistent issue with wide-ranging effects that are not completely understood by researchers or policy makers (Duncan, Morris, & Rodrigues, 2011).

Two studies reviewed retrospective population-level data by tracking aggregate findings of random-assignment of recipients to different types of programs providing government aid to low income families. These found that increasing family income through cash transfers created small but significant changes in children’s school outcomes (Dahl & Lochner, 2012; Duncan et al., 2011), and mother physical health (Evans & Garthwaite, 2014). The authors of both studies used an instrumental variables estimation approach to analyze aggregate data from multiple supplemental income programs in the U.S. They noted income effect on child development outcomes, namely, a .01 standard deviation increase in standardized math and reading scores for every $10,000 increase in family income (Dahl & Lochner, 2012) and .06 standard deviation increase in achievement for each $1,000 income increase (Duncan et al., 2011). The effects were notable for families with low income levels and younger children (Dahl & Lochner, 2012; Duncan et al., 2011).

Income differences are consistently associated with parenting differences in
complex ways (Klebanov, Brooks-Gunn, & Duncan, 1994). Mothers with fewer monetary resources often focus more on work and survival activities rather than advancing their interactions and surroundings to prepare for a more educated future for their infants (Lareau, 2002, 2003; Mistry, Benner, Biesanz, Clark, & Howes, 2010). Families in the lowest levels of SES have been found to be more likely to have home environments that are chaotic and less likely to offer developmentally supportive toys or cognitively stimulating routines (Brooks-Gunn, Klebanov, & Liaw, 1995). Infants find their learning opportunities within their daily environments. Beginning in early infancy, children in poverty are on a trajectory to be less ready to enter school compared with their peers from higher income households (Johnson, Riis, & Noble, 2016). This is partially due to comparatively lower quantity and complexity of early language and cognitive experiences often offered in lower income families (Hart & Risley, 1995, 2003; Sharkins, Leger, & Ernest, 2017). It also may be partially due to income-related stressors or concern about devoting scarce resources to infants (Conger et al., 2010) as well as restricted access to neighborhood and community resources such as quality childcare and adequate health care (Shuey & Leventhal, 2017).

Children in or near poverty are more likely to enter school with lower level abilities than their non-poor peers, likely due to parenting rather than the direct influence of income. Traits that appear as delays in childhood IQ and language processing can often be traced to parent-mediated income-related experiences during the first weeks and months of infancy (Betancourt et al., 2015, 2016). Parents who are stressed by income and parenting responsibilities may not have the emotional resources to attend to the
emotional and exploration needs of their infants (Conger et al., 2010; Deater-Deckard, 1998; Webster-Stratton, 1990). Patterns of opportunities infants have to explore their environment with and without mother support may become the beginning of developmental trajectories that will influence subsequent interactions between mothers and their infants (Morris et al., 2017; Ursache & Noble, 2016). Mothers with infants are especially susceptible to the stresses of parenting at a time when they are greatly needed by their infants for developmentally supportive interactions (Choe et al., 2013).

Some researchers have suggested psychosocial mechanisms behind the SES influence on family functioning and child development. Consideration of developmental knowledge and parenting stress, two parenting psychosocial resources that are more proximal to young infants than SES indicators, may provide a more nuanced explanation behind the mechanism for how maternal education and family income influence supportive parenting interaction behaviors and infant competence. Two researchers have begun to study potential mechanisms for how education and income may influence parenting interaction behaviors and child competence. Rowe et al. (2016) suggested that maternal education may be indirectly associated with parenting behavior through developmental knowledge. Deater-Deckard and Panneton (2017) suggested that income may be indirectly associated with parenting behavior through parenting stress.

**Developmental Knowledge**

Mothers with more formal education are likely to have higher levels of developmental knowledge (Bornstein et al., 2010; Rowe et al., 2016). Mothers who have skills to acquire knowledge may be more likely to see developmental knowledge as a
topic they can learn about when it becomes personally relevant, such as when they are expecting or have a young infant (Harding, 2015). The Early Childhood Longitudinal Study–Birth Cohort showed that the strong relation between maternal education and child language and literacy skills at nine years of age was partially mediated by mother’s parenting knowledge when measured in infancy (Rowe et al., 2016).

Mothers with knowledge that young infants are able to notice and respond to others’ emotions may be more likely to provide attentive, developmentally supportive interactions compared with mothers who do not know that infants have these abilities (Donovan et al., 2007). Mothers with developmental knowledge may be more aware of opportunities to follow the infants’ lead and allow for gradual extension of the infant’s abilities early in development rather than waiting for infants to begin to talk and make clear interaction attempts (Damast et al., 1996; Suskind et al., 2017b). These interactions, accompanied by child-directed speech, allow mothers to guide infant development through progressively complex interactions as the infant becomes ready (Rowe, 2008).

Mothers’ knowledge of how their parenting can support infant development may provide insight into their interaction behaviors. Mothers’ developmental knowledge increases the likelihood of having developmentally appropriate expectations for her infant (Bornstein et al., 2010) and is associated with later cognitive competence (Benasich & Brooks-Gunn, 1996). Lack of developmental knowledge, when related to inaccurate expectations about child abilities, can lead mothers to expect too much of their infants in some domains and not enough from their infants in other domains (Tamis-LeMonda et al., 2002). Asking too much of infants pushes them toward dysregulation and can create
stressful conflict and frustration for both mother and infant. However, providing too little interaction or asking too little of infants misses opportunities to provide stimulating learning opportunities. Developmental knowledge can bolster mothers’ parenting interaction quality while parenting stress can diminish it.

**Parenting Stress**

Parenting stress is a unique type of stress that relates directly to the demands and responsibilities of caring for at least one child (Deater-Deckard, Smith, Ivy, & Petril, 2005). Parenting stress is common, although it does not always reach critical levels that lead to detrimental outcomes (Crnic & Low, 2002), and it may be felt differently in response to different children even by the same mother (Deater-Deckard et al., 2005). When mothers feel that the demands of parenting have expanded beyond their resources for managing those demands, parenting stress occurs and can become a critical issue if not addressed (Deater-Deckard, 2004). Parenting stress saps mothers’ attention and interaction resources for infant care and can potentially disrupt the infant-mother relationship (Ayoub et al., 2011). Infant behaviors are often regulated by the mother in the early months, such that parental stress that interferes with the mother’s functioning impacts both members of the dyad (Cappa, Begle, Conger, Dumas, & Conger, 2011). Mother’s attributions of infant-related stress may add to parenting stress levels (Sparks et al., 2012) and further reduce the warmth and sensitive behaviors that may otherwise buffer the infant from family and community stressors (Belsky et al., 2007). In a mother-infant dyad, the partner who can consciously learn new interaction skills is the mother (Cohen et al., 1999); however, experiencing parenting stress makes it difficult for many
mothers to learn new skills until their stress is managed (Havighurst & Kehoe, 2017). During interactions with an infant, mothers who experience parenting stress by being distracted or withdrawing may not notice infant cues, thereby missing opportunities to teach, play, or provide comfort.

Mothers’ perceived level of resources influences their parenting stress and subsequent behaviors (Pianta & Egeland, 1990). Mothers who feel they have enough resources may view their parenting stress as manageable and just a part of the parenting process (Riley, Scaramella, & McGoron, 2014). However, mothers who feel they do not have enough resources may feel overwhelmed by their responsibility of caring for a young infant’s needs or distraught about not being able to invest in material supports for child development (Arnott & Brown, 2013; Nyström & Öhrling, 2004). Additionally, mothers may feel stressed if they are overwhelmed by a perceived need to educate their infant using specific parenting behaviors (Wall, 2010).

Although there have been numerous studies about parenting stress, few have clarified the mechanisms driving its effects on mothers, young infants, and families (Crnic & Low, 2002). Parenting stress can be compounded by factors such as socioeconomic or relationship stressors (Coyl, Roggman, & Newland, 2002; Rodriguez-Jenkins & Marcenko, 2014), increased difficulty in managing resources (Dunning & Giallo, 2012), or the perceived need to choose between parenting and career (Nomaguchi & Brown, 2011). Chronic parenting stress negatively influences parent behaviors over time, which can then interfere with positive infant development by increasing stress or reducing infant expectations for future interactions (Crnic, Greenberg, Ragozin,
Maternal education and family income both have been shown to be related to language, social emotional and cognitive competence, yet the mechanisms are poorly understood, especially in early infancy. For instance, there has been little continuity of defining SES across studies, although one team provides a good example of separating education and income to consider how they individually relate to early childhood and elementary school outcomes (Hackman et al., 2015). Additionally, only relatively recently has children’s language performance in kindergarten and elementary school been linked to SES rather than innate capacity of each individual child (Hart & Risley, 1995; Hoff, 2003; Pan, Rowe, Spier, & Tamis-LeMonda, 2004). It is possible that SES effects on early infant development are observable through differential levels of mother education and developmental knowledge or through how family income influences parenting stress. Mothers who have more developmental knowledge may have more developmentally supportive interaction behaviors including infant-directed talk or following the infant’s interest (Suskind et al., 2017b). Mothers who experience parenting stress may have parenting interactions that are harsh or aloof and do not support infant development.

The current study extended to younger infants previous research showing that developmentally supportive parenting during later infancy enhances later child outcomes, specifically socioemotional health and school readiness (Innocenti, Roggman, & Cook,
2013; Roggman et al., 2013a). Using a recently collected sample of low-risk mothers and their 13-37 week-old full term infants, the HOPED study explored how mothers’ socioeconomic and psychosocial resources were associated with their parenting interaction behaviors as measured with supplementary scoring guidelines added to an existing parent-child interaction measure. This study intentionally separated two socioeconomic indicators to explore whether income or education had a greater association with parenting behaviors for mothers of young infants, and whether any SES-parenting interaction associations were mediated by mothers’ psychosocial resources. This study extended previous research using Vygotsky’s sociocultural theory and Sameroff’s transactional model as a framework for exploring potential mechanisms that may help illuminate the connection between mothers’ SES resources and infant competence through psychosocial resources, developmental knowledge and parenting stress, and parenting interaction behaviors.

**Hypotheses**

1. Mothers with higher socioeconomic status, reflected in maternal education and family income, would interact more supportively with their infants.

2. Mothers with more parenting resources, reflected in more developmental knowledge and less parenting stress, would interact more supportively with their young infants.

3. Mothers’ developmental knowledge would partially mediate the association between maternal education and supportive interaction behaviors with their young
infants.

4. Mothers’ parenting stress would partially mediate the association between family income and supportive interaction behaviors with their young infants.

5. Mothers’ supportive interaction behaviors would partially mediate the associations between mothers’ parenting resources and their infants’ developmental competence.
CHAPTER III
METHODS

Research Approach

This study explored whether mothers’ socioeconomic and psychosocial resources were associated with parenting interaction behaviors and infant development using mother report of their socioeconomic and psychosocial resources, observation of their parenting behaviors and concurrent scores from a child development screening assessment. In addition to identifying parenting behaviors, this study identified potential resources parents draw upon when providing parenting interactions for their young infants. It tested the utility of using Parenting Interactions with Children: Checklist of Observations Linked to Outcomes + Baby (PICCOLO+B; Roggman, Cook, Innocenti, Jump Norman, Christiansen, & Anderson, 2013d) for identifying parenting behaviors of mothers with young infants in a low-risk sample.

A correlational design allowed investigation of data of newly collected variables from mothers and their young infants to address research questions about direct and mediated pathways from socioeconomic and psychosocial parenting resources to parenting interaction behaviors and infant developmental competence. An exploratory approach was warranted due to the lack of published research addressing potential direct and mediated associations amongst separate socioeconomic constructs, separate psychosocial constructs, parenting interaction behaviors, and infant competence in a sample of young infants and their mothers. A correlational approach was warranted due
to the lack of intervention, data from a single time point, and the lack of published
literature using similar measures in a single study.

**Extant Data**

This study used extant data from the 2017 Home Observation of Parenting and Early Development (HOPED) project, an ongoing research project in which students gain experience in research practices while also building upon previous research findings to answer new questions about child development, parenting and home visiting. Research participants included families with young infants who were visited once between November 2016 and May 2017 in their homes in the Intermountain West. Multiple types of data were collected: observation of parent-infant play interactions, measurement of child development, and parent report questionnaires. These data from the HOPED project had not been previously analyzed or published.

**Participants**

Participants were recruited using Institutional Review Board (IRB) approved methods. These included Facebook posts, direct invitation by a member of the research team, and community flyers in locations such as grocery stores, libraries, and parent service offices (including the Department of Workforce Services, the Department of Health, and the Women, Infants, and Children Program). Additionally, snowball sampling was used. For this recruiting approach, a HOPED researcher asked study participants to (a) consider mothers they knew who met the study criteria and then, (b) ask interested mothers to contact the research team to learn more about participating. This
combination of approaches led to a sample with a blend of known and unknown social and community connections.

Participants were mothers with their infants. There were three requirements for family participation: (1) the family included an infant between 3 to 9 months old at the time of recruitment for the first visit; (2) the research visit needed to take place within a 5-hour drive from Logan, Utah; and (3) the visits needed to be between November 2016 and May 2017. There was no compensation provided to participants.

**Procedures**

Two Institutional Review Board-approved, trained student researchers scheduled the research visits and traveled to the families’ homes at a time convenient to the family when the infant was likely to be rested and ready to play. The Informed Consent Form was reviewed by the researcher with each participating mother. Each mother signed the form and the visit then commenced in the following sequence: parent-child play session, researcher guided screening measurement of child development, and then parent report surveys.

During the play session mother and infant spent time together while being video-recorded for later scoring of parenting interactions. Each mother received a standardized set of materials: one silver color metal cake pan with opaque plastic lid, one set of multicolored nesting/stacking cups, one *My Face Book* cardboard book, and one multi-color plastic O-Ball. After spreading a 3’ x 4’ blanket on the floor and placing the materials on the blanket next to the mother and infant, the research home visitor provided the video-recording instructions. “Please play with your baby as you normally would, for
about 10 minutes. I’ll be quiet and not interact for that time, except if I need to remind
you to face the camera. At the end of 10 minutes, I will let you know. If we need to stop
sooner or take a break, that’s OK.” After the visit, videos were brought back to the
research lab where they were coded by a separate team.

During the researcher-guided parent measurement of child development, the
researcher administered a standardized child development screening measure designed to
include parents in the reporting process. Parent surveys consisted of the mother reporting
her answers to questions about family demographics, her knowledge of child
development, and her parenting stress.

Sample Characteristics

The sample included 79 mothers and their full-term infants (39 boys), which was
above the minimum needed for adequate statistical power for mediation analyses. Power
analysis indicated that for an effect size of .15, a power level of .80, a probability level of
.05, with three independent variables, a sample size of 76 cases would suffice (Soper,
2017). The HOPED study provided enough cases to test the hypotheses.

The majority of mothers were European American and all spoke English. Mothers
were adults ranging in age from 22-44 years ($M = 30.3$, $SD = 4.53$). All mothers were
married and all infants were full term. About a third of the mothers had one child, the
target infant who participated in HOPED. About a third of the mothers had at least some
college (29%), with the remainder having a bachelor’s degree or greater. Nearly 15%
were enrolled in school, a quarter worked full time, and about a quarter received state aid.
About 10% of families were in poverty at or below 100% of the federal poverty guideline (FGP). The remainder were split nearly equally between low-income (101-200% FGP) and higher income (over 201% FPG) groups. This was a low-risk sample. Table 1 provides additional sample information for mothers.

Infants ranged in age from 13-37 weeks (39 male; \( M = 23.06, \ SD = 5.52 \)). Table 2 provides specific sample information for infants.

**Measures**

The measures described below were used to assess family demographic

Table 1

*Descriptive Statistics for Mother Demographic Variables*

<table>
<thead>
<tr>
<th>Mother characteristics</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>22-42</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>79</td>
<td>100</td>
</tr>
<tr>
<td>Education some college</td>
<td>23</td>
<td>29.11</td>
</tr>
<tr>
<td>Education bachelors</td>
<td>37</td>
<td>46.84</td>
</tr>
<tr>
<td>Education post bachelors</td>
<td>19</td>
<td>24.05</td>
</tr>
<tr>
<td>In school or certificate program</td>
<td>11</td>
<td>13.92</td>
</tr>
<tr>
<td>Income &lt; 100% poverty line</td>
<td>7</td>
<td>8.90</td>
</tr>
<tr>
<td>Income between 101-200% poverty line</td>
<td>35</td>
<td>44.30</td>
</tr>
<tr>
<td>Income &gt; 200% poverty line</td>
<td>37</td>
<td>48.68</td>
</tr>
<tr>
<td>Mother not employed</td>
<td>29</td>
<td>36.71</td>
</tr>
<tr>
<td>Mother employed &lt;30 hrs/wk</td>
<td>30</td>
<td>38.00</td>
</tr>
<tr>
<td>Mother employed 30+ hrs/wk</td>
<td>20</td>
<td>25.32</td>
</tr>
<tr>
<td>Received state aid: WIC/SNAP/TANF</td>
<td>21</td>
<td>26.548</td>
</tr>
</tbody>
</table>
Table 2

*Descriptive Statistics for Infant Demographic Variables*

<table>
<thead>
<tr>
<th>Infant characteristics</th>
<th>$n$</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, male</td>
<td>39</td>
<td>49.40</td>
</tr>
<tr>
<td>Age (weeks)</td>
<td>13.14 – 37.00</td>
<td></td>
</tr>
<tr>
<td>No older siblings</td>
<td>30</td>
<td>38.00</td>
</tr>
<tr>
<td>1 older sibling</td>
<td>19</td>
<td>24.05</td>
</tr>
<tr>
<td>2 older siblings</td>
<td>15</td>
<td>18.99</td>
</tr>
<tr>
<td>3 or more older siblings</td>
<td>15</td>
<td>18.99</td>
</tr>
</tbody>
</table>

characteristics, child development knowledge, parenting stress, parenting interaction behaviors, and infant development competence. Some measures used for the HOPED project were also used in the Early Head Start Research and Evaluation Project (EHSREP; Love et al., 2002). In an attempt to minimize potential effects of having a broad range of infant development requiring three different age-appropriate forms of the infant competence measurement, data analyses were conducted controlling for the form version of the child development screener. In an attempt to maximize the accuracy of reliability for each measure with multiple items, reliability was calculated in SPSS to obtain the highest reliability score as measured by Cronbach’s alpha. The next section describes the process.

**Reliability Calculations**

For each measure with multiple items, Cronbach’s alpha score of internal consistency was calculated using SPSS to determine the measure’s reliability for assessing a particular construct. Tavakol and Dennick’s (2011) review of finding Cronbach’s alpha provided the guidance for these procedures. Calculating a measure’s
alpha level for this sample and assessing whether items needed to be removed was an iterative process that continued until the highest possible alpha level, indicating an item set’s highest reliability, was obtained. By computing the correlation for the measure’s total score with every item included, it was possible to see how each item contributed to the overall reliability of the measure. When there was a low alpha value for any complete measure, the contribution of each item to the measure was reviewed to assess whether removing that item would increase the alpha value for the measure. The steps were (a) calculate the grouped items, (b) identify and remove one item that indicated the most potential improvement in alpha score, (c) calculate the new set of items, (d) identify and remove the one item as needed to improve the alpha score, and (e) repeat this procedure until the highest alpha score indicated reliability could not be further improved. The final reliability score for each measure is provided following the measure description. The socioeconomic resource variables do not have reliability scores.

**Socioeconomic Resources**

Family demographic variables used for this study were available from mothers’ responses to the *Parent Information Questionnaire (PIQ)*, a two-page instrument created for the HOPED project that contained a range of questions to provide context for understanding the mother-infant relationship. All mothers completed the first 21 items with nominal and ordinal responses to questions about parent, family, and infant characteristics. This study used mothers’ responses to two questions from the PIQ: levels of maternal education and family income. These socioeconomic resources were each measured by single item at a single time point. A copy of the *PIQ* demographic form is
Maternal Education

Maternal education is a socioeconomic resource indicating the number of years a mother has spent in formal schooling. Education is considered a stable socioeconomic resource that can accumulate for as many years as the mother attends school and cannot be taken away from her (Bornstein & Bradley, 2003). Education attainment is associated with level of experience in a school setting and personal development as a learner. Mothers who have more education are likely to have more advanced skills of problem-solving, locating and using information, and communication skills that they can use in their parenting (Harding, 2015).

The PIQ maternal education question asked about the highest level of education the mother had completed by the day of the home visit. Maternal education chose from categorical options based on those used for the EHSREP (Administration on Children, Youth, and Families, 1998). There were eight potential levels: 1 = 1st - 8th grade, 2 = 9th - 11th grade, 3 = graduated high school, 4 = graduate equivalency degree (GED), 5 = some college or vocational school, 6 = graduated bachelor’s, 7 = graduated post-bachelor’s degree. Maternal education levels for the HOPED sample fell into three levels: some college or vocational school, college graduate at the bachelor’s level, and graduate at the post-bachelor’s level.

Family Income

Family income is a socioeconomic resource indicating the amount of money a
family receives through various means in a certain period of time. It is common to consider family income as an income-to-needs ratio, or, how many people in a family will be provided for with a certain level of income. Income is considered a relatively unstable socioeconomic resource that can vanish or change quickly (Bornstein & Bradley, 2003). Families with higher levels of income can typically access a wider range of items and opportunities compared to families who are in poverty. Mothers in lower income families may not be able to provide stimulating learning items, stable housing, safe neighborhoods, or quality schools for their children (Bradley et al., 2001).

The PIQ family income question asked the mother to consider her family size and eligible income and then choose from one of three income categories provided on a separate sheet with a table with a color-coded range of income levels. The table was created by the HOPED research team using 2013 Federal Poverty Guidelines (http://aspe.hhs.gov/2013-poverty-guidelines). Category A indicated a family income of at or below 100% FPG. Category B indicated a family income between 101-200% FPG. Category C indicated a family income at or above 201% FPG. Family income levels for this sample was unequally distributed but fell into all three categories.

The PIQ also addressed government aid the families may have been receiving. The PIQ grouped three types of government aid: Women, Infants, and Children (WIC), Temporary Assistance for Needy Families (TANF), and Supplemental Nutrition Assistance Program (SNAP). The qualification criteria for these sources of state and federal aid allow families to receive services if they are considered poor or near poor (up to 185% of the poverty guidelines; U.S. Department of Agriculture, 2017).
Developmental Knowledge

A mother’s knowledge of how infants develop and what types of parenting interactions are needed at what ages can help her choose different types of interactions with her infant. Using general knowledge about infants can alert the mother about what abilities to look for and support at certain ages with her own infant. In one study of 21-month-old infants and their mothers, mothers used their developmental knowledge to identify infant current level of play and make the effort to guide infants to the next level of complexity (Damast et al., 1996).

Knowledge of Infant Development Index, Short Form (KIDI-SF; MacPhee, 1983) is a widely-used parent questionnaire drawing from a knowledge base that pediatric professionals endorse for supporting early childhood development (Bornstein et al., 2010). These items address practices regarding child health and safety as well as developmental milestones in domains such as motor and communication. The 22 items used for the HOPED project were chosen from a longer list of items from the complete measure of the KIDI. The HOPED KIDI-SF items matched the age range of infants who were eligible to participate in the HOPED project. Three categories of items represented parent knowledge of infants under 12 months of age or younger for (1) developmental milestones, (2) parent perspectives on interacting with infants, and (3) general needs and characteristics of infants. The HOPED project version of the KIDI-SF used the 22 questions with no follow-up questions to address mother expectations for whether a statement she disagreed with would better match a younger or older child.
KIDI-SF contained 22 criterion-referenced infant-specific items on a 5-point Likert scale (1 = strongly disagree, 2 = mildly disagree, 3 = not sure, 4 = mildly agree, 5 = strongly agree). Questions included “A 1-year old knows right from wrong” and “A baby usually says his/her first real words by 6 months of age.” A similar version for older infants was used in the EHSREP (Administration for Children, Youth, and Families, 1998) and the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B; Andreassen & Fletcher, 2005).

KIDI-SF is an accepted measure for the Maternal, Infant and Early Childhood Home Visiting (MIECHV) program (James Bell Associates, 2016). KIDI-SF has an internal reliability of .82 and a test-retest reliability of .91 (MacPhee, 1983). For mothers, the split-half reliability coefficient was .85, and the two-week retest coefficient was .92 (Benasich & Brooks-Gunn, 1996). To address KIDI validity, a team of researchers conducted a linear structural relations (LISREL) confirmatory factor test (Hamilton & Orme, 1990) and determined that the KIDI met theoretical model expectations when compared with level of education and a measure of family conflict. Hamilton and Orme also found that the KIDI had high correlations with a parenting knowledge factor (.78). These results led the authors to endorse the KIDI as a measure with acceptable construct validity.

Reliability analyses for all 22 items used in HOPED KIDI-SF provided a low score, alpha = .51, but indicated that removing item 13 would increase reliability to alpha = .54. The results suggested that additionally removing item 1, which resulted in the highest possible reliability for this data set, indicated by alpha = .61. Removing additional
items would not have increased the reliability alpha. No other items were removed.

HOPED KIDI-SF scoring used the 20 items that remained after removing two items from the original 22 to increase the measure’s internal reliability. Likert scale response numbers, 1 through 5, were summed together to create a score of a mother’s knowledge of early infant development. The sum of possible scores ranged from 20 to 100. If mothers scored 70 or less (lower than 70% correct; Bornstein et al., 2010; McMillin et al., 2015), they were considered to have a low level of knowledge.

**Parenting Stress**

Parenting comes with great responsibility for keeping children alive and thriving. Many mothers experience stress related to an underlying concern that they do not have enough resources to care for their infant which may disrupt their parenting interactions (Deater-Deckard, 1998). Mothers may attribute their stress to different causes: the child’s characteristics, the parental responsibilities, and the parent-child interactions if they are difficult (Abidin, 1990).

The *Parenting Stress Index – Short Form (PSI-SF; Abidin, 1990)* is a widely used parent questionnaire addressing different types of stress parents feel due to their parenting responsibilities and relationship with their child. It was originally created for use with community samples and can be used to identify high and low levels of parenting stress related to different child and parent causes (Abidin, 1990; Deater-Deckard, 2004; Whiteside-Mansell et al., 2007).

The PSI-SF contains three subscales: parental distress; difficult child; and parent-child dysfunctional interaction. Each subscale has 12 items and uses a 5-point Likert
scale (1 = strongly disagree, 2 = mildly disagree, 3 = not sure, 4 = mildly agree, 5 = strongly agree). The parental distress and difficult child subscales were provided to mothers in the HOPED project visit; parent-child dysfunctional interaction scale was not included in the HOPED protocol. Only the parental distress subscale was used in the proposed study due to the design of measuring parenting distress and low variability of scores for the difficult child subscale. Questions from the parenting distress subscale include, “You often have the feeling you are not handling things very well,” and “You find yourself giving up more of your life to meet your child(ren)’s needs than you expected.” Working with a normative sample of 800 parents, Abidin found a Cronbach’s alpha reliability coefficient of .87 for the Parental Distress subscale and a test-retest reliability of .87 (Whiteside-Mansell et al., 2007).

In a recently published study using a sample of high-risk mothers (n = 58) with 12 – 15 month old infants, PSI-SF parental distress subscale reliability score test-retest average was adequate (α = .75; Barroso, Hungerford, Garcia, Graziono, & Bagn, 2016). Test-retest reliability estimates were good (α = .82). For the same group, convergent validity of the PSI-SF parental distress subscale with mother’s scores on the Center for Epidemiological Studies – Depression scale (CES-D) was r(.58) = p < .001. Predictive validity of the PSI-SF parental distress subscale was tested from Time 1 to Time 2 and found to be a significant predictor B = .77, t(45) = 7.15, p < .001, and “explained a significant proportion of the variance in Time 2 scores R² = .57, F(2, 45) = 29.94, p < .001” (Barroso et al., 2016, p. 6).

Reliability analyses for the HOPED sample indicated that the PSI-SF had good
reliability without removing any items. The PSI-SF Parenting Distress subscale scoring adds the number from each item with a range of 12 to 60 possible. Higher scores show greater reported parenting stress (Reitman, Currier, & Stickle, 2002). On the PSI-SF parental distress subscale, all mothers \( n = 79 \) scored from 13-47, or considered to have typical levels of stress when using the scoring manual (Abidin, 1990). For this sample, the PSI-SF reliability alpha = .77, which is adequate.

**Parenting Interactions**

Parenting interactions are a proposed mechanism for how parents influence child development, especially in the first few years of life. Infants are not directly affected by the presence or lack of family resources but instead depend on their caregivers to buffer them from difficult situations, respond to infant bids for attention, and introduce them to positively stimulating experiences. Parents preoccupied by their own psychosocial difficulties or worries about their caregiving responsibility may provide less nurturing care and infants are likely to be more stressed and feel less safe and engaged with the environment.

The *Parenting Interactions with Children: Checklist of Observations Linked to Outcomes* (PICCOLO; Roggman et al., 2013b) is an observational measure used to identify parenting interaction behaviors that support children’s early development. The PICCOLO measure was created to support home visitors and program providers in providing strengths-based feedback to parents of infants 10 months and older. A copy of the *29 Things Parents Do that Predict School Readiness*, aligned with PICCOLO and PICCOLO+B items, is included in Appendix C.
The PICCOLO consists of four domains of parenting behaviors (Affection, Responsiveness, Encouragement, and Teaching) that together contain 29 items describing different parenting behaviors known to support child development leading to positive outcomes in a range of domains. Using video-recorded observations, trained reliable coders rated parent behaviors using a three-level scale. Parent interactions were rated for each item using absent (0), barely (1), or clearly (2). When tallied, these ratings provided continuous scores in each domain ranging from 0-14 (0-16 for the Teaching domain). For the complete PICCOLO+B score, domain scores were summed resulting in total scores ranging from 0 – 58. The PICCOLO domain and total scores at ages 10-47 months have been shown to predict children’s competence at the end of preschool (60 months) and at the end of Grade 5 (11 years; Innocenti et al., 2013; Roggman et al., 2013b).

The PICCOLO has demonstrated good reliability and validity for observing caregivers interacting with children age 10-60 months. The PICCOLO research team tested and refined the interaction observation tool by using over 4,500 videos from over 2,000 families who participated in EHSREP (Roggman et al., 2013b). PICCOLO has been used to measure changes in parenting after prevention intervention for high risk families (Bagnato et al., 2015) and is a recommended measure for the MIECHV program (James Bell Associates, 2016). PICCOLO psychometric properties include internal consistency, with Cronbach’s alpha averaging .78 across domains and confirmatory factor analysis showing factor loadings averaging .65 within each domain (Innocenti et al., 2013; Roggman et al., 2013b). PICCOLO also shows strong predictive validity with child development in cognitive, language, and socioemotional areas at ages 2, 3, and
5 years (Roggman et al., 2013b).

The PICCOLO measure has been used, although not extensively, with parents of infants less than 10 months old. PICCOLO items have been found to be reliable for identifying developmentally supportive behaviors of parents of infants younger than 10 months (e.g., Clucas, 2015), but the items have not previously been officially tested for construct or predictive validity with younger infants (L. Roggman, personal communication, May 1, 2018). Parenting behaviors have been reliably identified using PICCOLO; however, the longitudinal child outcomes associated with those parenting behaviors have not yet been assessed with younger infants.

**PICCOLO+B**

The original PICCOLO has recently been extended with a supplementary packet that adds to each PICCOLO item a detailed description of observable developmental differences in younger infant characteristics and parenting interaction behaviors. A “+B” was added to the original PICCOLO name (PICCOLO+B) to indicate that considerations were made to address developmentally appropriate behaviors of babies under 10-months of age and their parent (Roggman, personal communication, May 1, 2018). Together, the original and supplementary scoring materials enable practitioners to provide feedback about their parenting interaction strengths and potential interventions for parents with younger infants. A copy of the *29 Things Parents Do that Predict School Readiness*, aligned with PICCOLO and PICCOLO+B items, is included in Appendix C.

PICCOLO+B scoring followed the practices outlined in the original PICCOLO User’s Manual and extended with the PICCOLO+B supplemental scoring packet.
(Roggman et al., 2013d). Trained and certified reliable university student coders watched the interaction videos and assigned codes for each item. Item scores were summed to obtain domain scores which were then summed to obtain an overall PICCOLO+B score as recommended (Roggman et al., 2013d).

The coding team consisted of graduate and undergraduate students recruited through flyers and class announcements at Utah State University. Students who provided coding services received course credit or monetary payment in return for their time. Student coders were trained in a series of steps with the support of the graduate student lab lead, a certified, reliable coder with multiple years of experience training student coders. First, students studied the coding instructions for PICCOLO and PICCOLO+B independently and discussed clarifications in training groups. Second, they used an online Canvas course to practice applying their knowledge through short vignettes, practice videos, and mastery quizzes. Third, upon passing all Canvas module requirements and demonstrating proficiency with knowledge and practice content, students were qualified to watch a series of reliability testing videos. Each student independently worked toward reliability by scoring within the acceptable range on every domain compared with gold-standard codes established by the PICCOLO authors. Fourth, upon being certified as reliable, each coder was coached to work with the PICCOLO+B extension materials in order to expand coding descriptions to parent interactions with younger infants.

The majority of the video-recorded observations lasted 10 minutes. A few videos were shorter due to interruptions. Videos were coded if they were at least 5 minutes long. One mother began the observation session with the standard HOPED parent-child
interaction materials and chose to switch to a more familiar activity of watching fish in their aquarium after the infant cried partway through the observation. One family had interruptions midway through their video recording resulting in two short videos rather than one long video. The two videos were scored as a single video.

For the HOPED project, inter-rater reliability was estimated using intra-class correlations from two observers coding the same video observation for approximately 20% of the cases, ICC = .75 for the total PICCOLO+B score and ranges from .57 to .81 for the domains. Scale reliability for PICCOLO+B is good, alpha = .85. Inter-rater reliability was estimated by intra-class correlations (ICC) from two observers coding the same video observation for approximately 20% of the cases maintaining > .85 reliability. Scale reliability for PICCOLO+B was good, alpha = .85, and ranged from .53 to .81 for the domains. There were two (out of four) PICCOLO+B domains that displayed higher reliability if one item was removed. For the affection domain, removing item 5 increased alpha from .43 to .53. For the teaching domain, removing item 5 increased alpha from .55 to .60. All tables that include the PICCOLO+B domains were calculated using the combination of item scores that provided the highest reliability.

**Infant Competence**

Infant development unfolds rapidly in the first 8 months of life. Infant behaviors may seem trivial to an adult; however, infants need time to explore, try new activities, and interact with people in order to expand their foundational skills and progress in their development. Skills are formed in a sequential fashion, building on each other over time (Cunha & Heckman, 2007).
The *Ages & Stages Questionnaire-3 (ASQ-3; Squires & Bricker, 2009)* is a brief screening measure for tracking development across early childhood. It has become one of the most widely used developmental screening measures by researchers and health practitioners. Final scores determine whether infants and young children’s developmental level indicates followup with a norm-referenced developmental assessment would be beneficial (Ballantyne, Benzies, McDonald, Magill-Evans, & Tough, 2016; Graybill et al., 2016; Valla, Janson, Wentzel-Larsen, & Slinning, 2016). Using a developmental screening measure provided a quick look at infant competence to identify if each infant was meeting or missing the cutoff scores for each domain. For this study, determining whether there was a significant correlation between parenting interactions and infant competence indicated whether these two measures could be used together meaningfully.

The ASQ was designed as an efficient and affordable way to help parents and practitioners determine whether young children are developing according to a typical timeline or if there were delays that should be monitored or referred for extra services (Squires, Twombly, Bricker, & Potter, 2009). Each age-level ASQ-3 form consists of 30 items pertaining to child development and eight additional questions about a range of parent concerns. The parent concerns sheet, primarily for clinical rather than research purposes, was not used in this study. Developmental competence items are grouped into five areas with six items each: communication, fine motor, gross motor, problem solving, and personal-social (Squires et al., 2009). Reliability tests were based on developmental reports by 18,572 parents (9,733 in print and 8,839 online) who completed the ASQ-3 form suited to their child’s age (1 to 60 months). Family characteristics varied in terms of
parental education, family income level, child risk status, and child ethnicity. Internal consistency of the scales ranged from .67 to .91. The test-retest reliability was .94 (Squires, Bricker, & Twombly, 2004). Specificity and sensitivity were both 85% (Mackrides & Ryherd, 2011).

The ASQ team configured cut-off scores based on identifying the mean value for thousands of young children’s scores and then subtracted scores that signify the first and second standard deviation away from that mean (Squires et al., 2009). The forms can be used to track development within the same child as well as to compare children’s scores. Final scores from each ASQ area (each with five items) can be used to broadly compare children’s developmental functioning. For children below 9 months of age, each ASQ form covers a two-month age range (e.g., child age 3 months 0 days to 4 months 30 days).

During the HOPED research home visit, each mother was guided by the visitor to provide answers using the ASQ’s three-level scale: Always (10 points); Sometimes (5 points); or Not Yet (0 points). For each item the mother considered whether the infant had displayed each behavior during or before the visit and offered their best estimate of the frequency of that behavior. The infant age range of the HOPED sample required three versions of the ASQ form: 4, 6, and 8 months. Following the manual instructions, points were tallied for each domain and then compared to a developmental guidelines scale provided with the measure.

To identify the range of infant competence, cutoff scores were calculated using provided ASQ guidelines for each area. Total domain scores were a sum of all item
values. Each ASQ age-related form provides its own cutoff scores that are different from forms for other ages. The appropriate cutoff score was used for calculating the expected minimum score for each infant age. Scale reliability for the total ASQ was adequate, alpha = .71, and ranged from .36 to .53 across areas of development. Fifty-nine (74.70%) infants met the expected minimal scores to indicate typical development. Thirteen (16.50%) infants did not meet minimal scores in one area, five (6.30%) did not meet minimal scores in two areas, and two (2.50%) did not meet minimal scores in three areas. All tables for this chapter that include the ASQ areas were calculated using the grouped-item scores, called areas (e.g., personal social), that provided the highest reliability.

For the HOPED sample, there were four (out of five) ASQ areas that displayed higher reliability if one item was removed. For the fine motor area, removing item 1 increased alpha from .49 to .55. For the gross motor area, removing item 4 increased alpha from .49 to .53. For the problem solving area, removing item 4 increased alpha from .41 to .48. For the personal social area, removing item 6 increased alpha from .33 to .40.

Measures used to collect information about parenting experiences included mother self-report of maternal education and family income SES resources, developmental knowledge and parenting stress psychosocial resources, mother-infant free play interaction videos later coded by the research team, and guided maternal report of infant competence. Table 3 provides central tendency, range, distribution, and final reliability estimates of each research measure, including subscales when applicable.
Data Management and Analysis

Data Management

Before data were provided for analyses, they were de-identified by a Collaborative Institutional Training Initiative (CITI) certified member of the lab who was not the student who wrote this dissertation. In the months when data were collected, a trained, CITI-certified student researcher visited each mother-infant pair, returned to the lab, added a unique participant identification code to materials (video and paper forms), and filed the Informed Consent Form in a separate secure location. Each parent-child interaction video was stored in three secure locations to ensure against data loss. For data cleaning, two student researchers independently entered data from forms into two separate Excel workbooks. These workbooks were compared for data reliability. When data sheets did not match, individual mismatched items were corrected using the original hardcopy forms. The lab manager provided a final Excel sheet that was then converted to SPSS format for data analyses using SPSS 24 analysis software. Data were checked for outlying data points and unexpected values before completing planned analyses.

PICCOLO+B codes were provided in an Excel sheet from the supervisor of a team of trained PICCOLO+B coders. Coders had previously viewed and scored each video-recorded observation of parent-child interactions. All videos were coded by at least one coder with 20% of the videos coded by two coders to establish inter-rater reliability.
Table 3

**Descriptive Statistics for All Study Variables**

<table>
<thead>
<tr>
<th>Items</th>
<th>Possible range</th>
<th>Actual range</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>α</th>
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<tbody>
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<td>Mother age (years)</td>
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<td>–</td>
<td>22 - 42</td>
<td>29.94</td>
<td>4.37</td>
<td>.48</td>
<td>-.22</td>
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<tr>
<td>Infant age (weeks)</td>
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<td>–</td>
<td>13 - 37</td>
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<td>.49</td>
<td>-.517</td>
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<td>-1 - 1</td>
<td>-0.05</td>
<td>.08</td>
<td>.08</td>
<td>-1.10</td>
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<td>1</td>
<td>0 - 1</td>
<td>0 - 1</td>
<td>.47</td>
<td>.50</td>
<td>.13</td>
<td>2.04</td>
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<td>-1 - 1</td>
<td>.38</td>
<td>.65</td>
<td>.56</td>
<td>-.62</td>
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<tr>
<td>Socioeconomic status</td>
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<td>-1.72 - 1.20</td>
<td>.00</td>
<td>.78</td>
<td>-.17</td>
<td>-.71</td>
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<td>Dev. knowledge</td>
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<td>20 - 100</td>
<td>70 - 96</td>
<td>87.06</td>
<td>5.73</td>
<td>-.69</td>
<td>-.06</td>
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<td>12 - 60</td>
<td>13 - 45</td>
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<td>6.96</td>
<td>.71</td>
<td>.14</td>
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<td>26 - 54</td>
<td>42.80</td>
<td>6.75</td>
<td>-.54</td>
<td>.07</td>
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<td>6 - 12</td>
<td>11</td>
<td>1.17</td>
<td>-1.54</td>
<td>3.43</td>
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<td>7 - 14</td>
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<td>1.82</td>
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<td>3 - 14</td>
<td>11.28</td>
<td>2.58</td>
<td>-.90</td>
<td>.33</td>
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<tr>
<td>Teaching</td>
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<td>1 - 13</td>
<td>6.80</td>
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<td>.16</td>
<td>-.17</td>
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<td>Infant competence</td>
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<td>105 - 280</td>
<td>232.78</td>
<td>36.12</td>
<td>-.94</td>
<td>.86</td>
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<td>Communication</td>
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<td>0 - 60</td>
<td>10 - 60</td>
<td>46.65</td>
<td>9.96</td>
<td>-1.05</td>
<td>1.26</td>
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<td>36.46</td>
<td>11.38</td>
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<td>-.10</td>
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<td>Gross motor</td>
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<td>10 - 50</td>
<td>40</td>
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<td>Problem solving</td>
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<td>0 - 50</td>
<td>5 - 50</td>
<td>40.25</td>
<td>9.26</td>
<td>-1.50</td>
<td>2.97</td>
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<tr>
<td>Personal social</td>
<td>5</td>
<td>0 - 50</td>
<td>10 - 50</td>
<td>40.44</td>
<td>9.45</td>
<td>-1.28</td>
<td>1.52</td>
</tr>
</tbody>
</table>

*Note. For the table, skewness standard error = .27 and kurtosis standard error = .54. Each measure of developmental knowledge and parenting stress has one set of items. The parenting interactions and child competence measures both have multiple item sets. For PICCOLO+B domains, before removing affection item 5, alpha = .43. Before removing teaching item 5, alpha = .55. For ASQ areas, before removing fine motor item 1, alpha = .49. Before removing gross motor item 4, alpha = .49. Before removing problem solving item 4, alpha = .41. Before removing personal social item 6, alpha = .33.*
All coders were certified using CITI to ensure human subjects protection as per the research protocol approved by the Institutional Review Board of Utah State University. Data were stored in protected files on password protected computers in locked offices. All videos were assigned non-identifying identification numbers to protect participant identity. After video coding, the PICCOLO+B scores were de-identified before they were made available for analysis with other measures from the HOPED project.

**Data Analysis**

Data analyses to address the research questions consisted of exploring correlations between hypothesized dependent and independent variables, as well as examining potential mediator variables. To test the hypothesis that the effect of SES on parenting interaction behaviors was mediated by parent psychosocial resources, separate simple regression analyses were conducted for each pair of variables to determine whether a zero-order correlation relationship was present. This was followed by multiple regression analysis to determine whether the independent variable or the proposed mediating variable predicted the outcome variable.

The process used to determine whether an association between income and parenting interactions was mediated by parenting stress consisted of the following steps: (1) simple regression to test the association between income and parenting interactions; (2) simple regression to test the association between income and parenting stress; (3) simple regression to test the association between parenting stress and parenting interactions; and (4) multiple regression to determine whether both income and parenting
stress predict parenting interactions. Final mediation was tested with a Sobel test.

A couple of studies provided precedence for investigating potential mediated associations. One team in Bogota, Columbia found that for young children 6 to 24 months of age, maternal education was a mediator between family financial resources and young child competence, partially due to the home environment and responsiveness of the more highly educated mothers (Rubio-Codina, Attanasio, & Grantham-McGregor, 2016). A longitudinal study of U.S. rural mothers with their infants from 6 to 36 months old found that the association between family economic pressures at infant age 15 months influenced sensitive parenting but was mediated by parents’ psychosocial resources including depression and anxiety (Newland, Crnic, Cox, Mills-Koonce, & Family Life Project Key Investigators, 2013).

Dependent variables included in these analyses were parenting scores measuring parenting interaction behaviors (PICCOLO+B) and infant competency scores (ASQ); independent variables included maternal education and family income measuring SES, as well as developmental knowledge scores (KIDI-SF) and Parental Distress subscale of PSI-SF scores measuring parenting psychosocial resources. All correlation and regression analyses covaried for ASQ form version to control for spurious influences while potentially increasing statistical power (Taylor & Innocenti, 1993).

Tests of data normality including visual inspection of the histograms, normal Q-Q plots, and box plots showed that some research measure scores were slightly negatively skewed. This indicated that this sample had high levels of developmental knowledge, parenting interactions, and infant competence. There was limited variability in education,
developmental knowledge, and the parenting interaction scores. There was comparatively more variability of parenting stress but all mothers were low risk. Measures had different numbers of outlier cases (between 0 and 4). There were no consistent patterns for outlier cases, and this was an exploratory study, so these cases were not removed from the larger sample. Shapiro-Wilk tests showed that all measures had statistically significant non-normality. There were some differences when considering different grouping variables, for instance, parenting interactions were normally distributed for lower income families, but not for higher income families. However, the skewness and kurtosis were below standard cutoffs that would have indicated a need for data transformation or additional analyses such as bootstrapping (Hoyle & Kenny, 1999).

The analysis approach for each research question is described below.

1. Do mothers with higher socioeconomic status, as measured by maternal education and family income, interact more supportively with their infants? This question was addressed by examining both the bivariate correlations of supportive interaction behaviors (PICCOLO+B scores) with education and income and the contribution of education and income as independent variables in multiple regression analyses with mothers’ supportive interaction behaviors as a dependent variable.

2. Do mothers with more parenting resources, as measured by more developmental knowledge (KIDI-SF score) and less parenting stress (PSI-SF Parental Distress score), interact more supportively with their young infants? Similarly, to the previous question, data analysis for this question examined the bivariate correlations of mothers’ supportive interaction behaviors with their developmental knowledge and
parenting stress and the contribution of developmental knowledge and parenting stress as independent variables in multiple regression analyses with mothers’ supportive interaction behaviors as the dependent variable.

3. Does mothers’ developmental knowledge mediate any of the association between maternal education and supportive interaction behaviors with their young infants? This question was addressed with accepted procedures for testing mediation by examining a series of multiple regression models with maternal education, as a more distal independent variable and developmental knowledge, as a more proximal potentially mediating variable. Reduced predictive power of maternal education when developmental knowledge was added to the model would suggest an indirect effect. The statistical significance of an indirect effect would be tested with a Sobel test using the unstandardized coefficients and standard errors for the path from maternal education to developmental knowledge and for the path from developmental knowledge to developmentally supportive interaction behaviors.

4. Does mothers’ parenting stress mediate any of the association between family income and supportive interaction behaviors with their young infants? Similar to the previous question, data analysis would test mediation by examining a series of multiple regression models, with family income as the more distal independent variable, parenting stress as the more proximal and potentially mediating variable, and mothers’ supportive interaction behaviors as the dependent variable.

5. Do mothers’ supportive interaction behaviors mediate any of the associations between mothers’ parenting resources and their infants’ developmental competence? This
question was addressed by examining a series of multiple regression models with infant
developmental competence as a dependent variable, and developmental knowledge,
parenting stress, and mothers’ supportive interaction behaviors as predictors. Reduced
predictive power of developmental knowledge and parenting stress when supportive
interaction behaviors were added to the model would suggest an indirect effect, for which
statistical significance would be tested with Sobel tests using the unstandardized
coefficients and standard errors for the paths from developmental knowledge and
parenting stress to interaction behaviors and from interaction behaviors to child
development.
CHAPTER IV
RESULTS

This study investigated whether maternal socioeconomic and psychosocial resources were associated with mothers’ parenting behaviors and, in turn, with their young infants’ developmental competence. Taking an exploratory, correlational approach, this study used multiple types of data collected during a home visit with each mother and her infant between 13-37 weeks old in a convenience sample of mothers.

This chapter presents the results of analyses of associations amongst specific constructs addressed by research hypotheses. For each hypothesis, partial correlation analyses were conducted, controlling for ASQ month form version (4, 6, or 8). Multiple regression was used as appropriate. All calculations used the highest inter-item reliability scores available. The Parenting Stress Index Short Form, Parental Distress Subscale (PSI-SF; Abidin, 1990) retained all items to keep the highest inter-item reliability level. Each of the following measures, considered as a complete unit or as smaller subsets of items, displayed the highest inter-item reliability level when one item was removed. Knowledge of Infant Developmental Index Short Form (KIDI-SF; MacPhee, 1983) measured mother’s developmental knowledge. Parenting Interactions with Children: Checklist of Observations Linked to Outcomes + Baby (PICCOLO+B; Roggman et al., 2013d) measured parenting interactions by considering four “domains” separately and together. Ages and Stages Questionnaire-3 (ASQ-3; Squires & Bricker, 2009) measured infant competence in five “areas” separately and combined. Table 4 provides bivariate correlations between constructs at the complete measure and measure sublevels.
### Table 4

**Bivariate Correlations Between Study Constructs Including Total, Domain, and Area Scores**

<table>
<thead>
<tr>
<th>Construct</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
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<tbody>
<tr>
<td>1. Mother age</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>2. Infant age</td>
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<td>–</td>
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<tr>
<td>3. Maternal education</td>
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<td>–</td>
<td></td>
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<td></td>
<td></td>
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<td>4. Family income 2 levels</td>
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<td>.24*</td>
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<td>5. Family income 3 levels</td>
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<td>.17</td>
<td>.23*</td>
<td>.91**</td>
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<td>6. Developmental knowledge</td>
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<td>-.24*</td>
<td>.01</td>
<td>.10</td>
<td>.07</td>
<td>–</td>
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<td>7. Parenting stress</td>
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<td>.29**</td>
<td>.01</td>
<td>-.12</td>
<td>-.08</td>
<td>-.13</td>
<td>–</td>
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<td>.13</td>
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<td>9. Affection</td>
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<td>11. Encouragement</td>
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<td>-.01</td>
<td>.14</td>
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<td>.04</td>
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<td>.81**</td>
<td>.48**</td>
<td>.44**</td>
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<td>13. Infant competence</td>
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<td>-.01</td>
<td>-.10</td>
<td>-.01</td>
<td>.10</td>
<td>.02</td>
<td>-.05</td>
<td>.07</td>
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<tr>
<td>14. Communication</td>
<td>-.31**</td>
<td>-.20+</td>
<td>-.10</td>
<td>-.17</td>
<td>-.17</td>
<td>.01</td>
<td>-.10</td>
<td>-.06</td>
<td>-.17</td>
<td>-.09</td>
<td>-.15</td>
<td>.08</td>
<td>.57**</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Fine motor</td>
<td>-.12</td>
<td>.32**</td>
<td>.11</td>
<td>.13</td>
<td>.05</td>
<td>-.12</td>
<td>.28*</td>
<td>.12</td>
<td>.04</td>
<td>.15</td>
<td>.12</td>
<td>.76**</td>
<td>.24**</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Gross motor</td>
<td>-.20+</td>
<td>-.32**</td>
<td>.08</td>
<td>.01</td>
<td>-.09</td>
<td>.18</td>
<td>-.02</td>
<td>-.02</td>
<td>-.10</td>
<td>-.24**</td>
<td>.04</td>
<td>.58**</td>
<td>.18</td>
<td>.25*</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Problem solving</td>
<td>-.12</td>
<td>.02</td>
<td>.11</td>
<td>-.01</td>
<td>-.07</td>
<td>-.09</td>
<td>.10</td>
<td>.04</td>
<td>-.02</td>
<td>.13</td>
<td>-.05</td>
<td>.07</td>
<td>.75**</td>
<td>.21+</td>
<td>.61**</td>
<td>.40**</td>
<td>–</td>
</tr>
<tr>
<td>18. Personal social</td>
<td>-.07</td>
<td>.01</td>
<td>-.04</td>
<td>-.07</td>
<td>-.11</td>
<td>-.12</td>
<td>.09</td>
<td>-.01</td>
<td>-.02</td>
<td>.12</td>
<td>.00</td>
<td>-.08</td>
<td>.61**</td>
<td>.30**</td>
<td>.37**</td>
<td>.16</td>
<td>.33**</td>
</tr>
</tbody>
</table>

**Note.** Construct 4, “Family income 2 levels,” uses the original three categories of income (> 100%; 101-200%; <201%) combined into two categories: ≤200% and ≤201%. Construct 5, “Family income 3 levels,” uses the original three categories of income.

**p < .001.

*  p < .05.

+  p < .10.
Figure 1. Hypothesized associations between constructs based on literature reviewed.

Figure 1 provides a visual representation of the hypothesized associations between constructs. Except for Table 4 results, ASQ month form version (4, 6, or 8; a proxy for infant age) was a covariate to account for the wide range of infant age groups.

**Research Hypotheses**

Statistical analyses for hypothesis 1 tested whether parenting interactions were predicted by SES indicators of income and education. Hypothesis 2 tested whether parenting interactions were predicted by parent psychosocial resources of developmental knowledge and parenting stress. Hypothesis 3 examined whether developmental knowledge mediated any association between parent education and mothers’ parenting interactions. Hypothesis 4 examined whether parenting stress mediated any association between family income and mothers’ parenting interactions. Hypothesis 5 examined whether mothers’ parenting interaction behaviors mediated any association between mothers’ psychosocial parenting resources and their infants’ developmental competence.
For these exploratory questions, an alpha, or \( p \) value, of \( \leq .05 \) was accepted as indication of statistical significance. Tests with alpha levels between .06 and .10 were reported as trends. Analyses were conducted using SPSS version 24. The design was correlational and the approach was exploratory, addressing research questions about direct and mediated pathways from socioeconomic and psychosocial parenting resources to parenting interaction behaviors and infant developmental competence.

**Hypothesis 1**

Hypothesis 1 proposed that mothers with higher socioeconomic status, reflected in greater levels of maternal education and family income, would interact more supportively with their infants compared with mothers with lower levels of maternal education and family income. This research question was first addressed by examining the bivariate correlations of maternal education and family income with mothers’ parenting interaction behaviors as was seen in Table 4. Table 5 shows that using the entire sample with ASQ form as a covariate, parenting interactions were not significantly

Table 5

*Partial Correlations Between SES Resources and Parenting Interactions*

<table>
<thead>
<tr>
<th>Construct</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Maternal education</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Family income (2 levels)</td>
<td>.26*</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>3 Family income (3 levels)</td>
<td>.27*</td>
<td>.91**</td>
<td>–</td>
</tr>
<tr>
<td>4 Parenting interactions</td>
<td>.13</td>
<td>.14</td>
<td>.03</td>
</tr>
</tbody>
</table>

*Note. ASQ form version as a covariate.*  
** \( p < .01 \).  
* \( p < .05 \).
associated with SES indicators for either maternal education or family income, although
the two SES indicators were significantly correlated with each other.

Maternal education was significantly correlated with family income at two levels,
$r (76) = .26, p = .02$, and three levels, $r (76) = .27, p = .02$. As expected, both maternal
education and family income were significantly correlated with maternal age, $r (76) = .33, p = .00$, and $r (76) = .29, p = .01$, respectively. Income at two levels was trending-
toward-significantly correlated with maternal age, $r (76) = .21, p = .07$. Multiple
regression with SES indicators using ASQ month form version as a covariate (Table 6)
did not significantly predict parenting interactions. To follow that analysis, a single SES
variable was constructed by combining the income and education variables with similar
results (Table 7). Not surprisingly, given the limited variability in SES for this sample,
neither education nor income was significantly related to the amount of supportive
interactions mothers showed with their infants.

As an additional follow-up, SES variables were explored in relation to the
separate parenting domains. Parenting interactions did not differ significantly by family

Table 6

Regression Analysis for Predicting Parenting Interactions from Education and Income

<table>
<thead>
<tr>
<th>Construct</th>
<th>Model 1</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
<td>β</td>
<td>t(77)</td>
<td>p</td>
<td>B</td>
<td>SE</td>
<td>β</td>
</tr>
<tr>
<td>ASQ form version</td>
<td>-0.13</td>
<td>0.54</td>
<td>-0.03</td>
<td>-0.25</td>
<td>0.81</td>
<td>-0.09</td>
<td>0.58</td>
<td>-0.02</td>
</tr>
<tr>
<td>Maternal education</td>
<td>1.27</td>
<td>1.11</td>
<td>0.14</td>
<td>1.14</td>
<td>0.26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family income (3-level)</td>
<td>-0.08</td>
<td>1.26</td>
<td>-0.01</td>
<td>-0.06</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Model 2 $R^2 = .06$, n.s.
Table 7

*Regression Analysis for Predicting Parenting Interactions from a Combined SES Variable*

<table>
<thead>
<tr>
<th>Construct</th>
<th>Model 1</th>
<th></th>
<th></th>
<th></th>
<th>Model 2</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
<td>β</td>
<td>t(77)</td>
<td>p</td>
<td>B</td>
<td>SE</td>
<td>β</td>
</tr>
<tr>
<td>ASQ form version</td>
<td>-.13</td>
<td>.54</td>
<td>-.03</td>
<td>-.25</td>
<td>.81</td>
<td>-.13</td>
<td>.54</td>
<td>-.03</td>
</tr>
<tr>
<td>SES (3 levels of income)</td>
<td>.88</td>
<td>.98</td>
<td>.10</td>
<td>.90</td>
<td>.37</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Model 2 $R^2 = .01$, n.s.

income level. Mothers with higher income had a middle level mean score for parenting interactions with their infants ($n = 37; M = 43.76; SD = 6.72$) compared with mothers in low income families ($n = 35; M = 41.00; SD = 6.78$), and mothers in poverty who had the highest mean score with the lowest standard deviation, possibly due to the small group size ($n = 7; M = 46.71; SD = 4.39$). The combined low-income group ($n = 42; M = 41.95; SD = 6.75$) showed comparable scores to the higher income group.

Table 8 shows the partial correlations for all SES categories to explore the association of SES with parenting interaction behaviors of affection, responsiveness, encouragement, and teaching. Maternal education was significantly associated with responsiveness $r(76) = .22, p = .05$.

**Follow-up Analyses**

**Follow-Up Analyses for Education**

To examine specific parenting interaction domains in relation to specific infant competence domains, additional multiple regression models were tested with ASQ form
version controlled. Similar to Table 8 findings, the only results showing a significant

Table 8

*Partial Correlations of SES Resources with Parenting Interaction Domains*

<table>
<thead>
<tr>
<th>Domain</th>
<th>Maternal education</th>
<th>Family income (2 levels)</th>
<th>Family income (3 levels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affection</td>
<td>.15</td>
<td>.16</td>
<td>.06</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>.22*</td>
<td>.09</td>
<td>.02</td>
</tr>
<tr>
<td>Encouragement</td>
<td>.15</td>
<td>.09</td>
<td>.01</td>
</tr>
<tr>
<td>Teaching</td>
<td>-.03</td>
<td>.15</td>
<td>.03</td>
</tr>
</tbody>
</table>

*Note. ASQ month form as a covariate.  
* p < .05.

association with maternal education was between parenting responsiveness domain and maternal education (Table 9).

Separating mothers by education category and controlling for ASQ month form version (4, 6, or 8) revealed differences between how the constructs were associated within each education category. The groups of mothers in the three categories are not identical in terms of their age range or number of children, as displayed in Table 10.

PICCOLO+B total scores on observed parenting interactions (range = 26-54) did not differ significantly by maternal education, whether mothers had only some college experience (n = 23; M = 42.48; SD = 6.78), graduated with a bachelor’s degree (n = 37; M = 41.77; SD = 7.24), or a post-bachelor’s degree (n = 19; M = 45.18; SD = 5.33).

Mothers in each education category reported receiving government assistance: some college (n = 8, 35%), bachelor’s (n = 11, 30%), and post-bachelor’s (n = 2, 11%).

Table 11 shows 24 significant and trending-toward-significant partial correlations
Table 9

Regression Analysis for Predicting Responsiveness Interaction Domain from Education

<table>
<thead>
<tr>
<th>Construct</th>
<th>Model 1</th>
<th></th>
<th></th>
<th></th>
<th>Model 2</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
<td>β</td>
<td>t(77)</td>
<td>p</td>
<td>B</td>
<td>SE</td>
<td>β</td>
</tr>
<tr>
<td>ASQ form version</td>
<td>-.10</td>
<td>.15</td>
<td>-.08</td>
<td>-.68</td>
<td>.50</td>
<td>-.05</td>
<td>.15</td>
<td>-.04</td>
</tr>
<tr>
<td>Maternal education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.56</td>
<td>.28</td>
<td>.22</td>
</tr>
</tbody>
</table>

*Note. Model 2 $R^2 = .06$, n.s.  
*p ≤ .05.

Table 10

Demographic Information in Three Education Categories

<table>
<thead>
<tr>
<th>Education</th>
<th>Total (n)</th>
<th>Maternal age range (years)</th>
<th>ASQ 4-month form (n)</th>
<th>ASQ 6-month form (n)</th>
<th>ASQ 8-month form (n)</th>
<th>Infant with siblings (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some college</td>
<td>23</td>
<td>22 - 36</td>
<td>7</td>
<td>12</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Bachelor’s</td>
<td>37</td>
<td>25 - 39</td>
<td>20</td>
<td>11</td>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>Post-bachelor’s</td>
<td>19</td>
<td>24 - 42</td>
<td>10</td>
<td>8</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

between construct pairs within each category of mothers’ education, controlling for ASQ form version. Mothers with some college had a mix of positive and negative correlations between constructs. Mothers with bachelor’s degrees had the highest number of associations between constructs that were all positive with a mix of significant and trending-toward-significance. Mothers with post-bachelor’s degrees had few significant associations between constructs; all were negative and trending-toward-significance. In the three instances when two education categories included significantly associated constructs, the correlations were in the opposite directions and ranged from strong to moderately strong.
Table 11

*Partial Correlations Between Constructs, Three Education Categories*

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Some college (n = 23)</th>
<th>Bachelor’s (n = 37)</th>
<th>Post-bachelor’s (n = 19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income 2 levels w/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affection</td>
<td>.39+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td>-.43+</td>
<td></td>
</tr>
<tr>
<td>Developmental knowledge w/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parenting interactions</td>
<td>.29+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affection</td>
<td>.39+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsiveness</td>
<td>.31+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant competence</td>
<td>.29+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine motor</td>
<td>-.47*</td>
<td>.29+</td>
<td></td>
</tr>
<tr>
<td>Personal social</td>
<td>-.38+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parenting stress w/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant competence</td>
<td>.41*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine motor</td>
<td>.40*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross motor</td>
<td>.41*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem solving</td>
<td>.34*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal social</td>
<td>.29+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychosocial resources w/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant competence</td>
<td>-.39+</td>
<td>.46*</td>
<td></td>
</tr>
<tr>
<td>Fine motor</td>
<td>.45*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross motor</td>
<td>.40*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem solving</td>
<td>.29+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal social</td>
<td>-.40+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affection w/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine motor</td>
<td>.40+</td>
<td></td>
<td>-.58+</td>
</tr>
<tr>
<td>Gross motor</td>
<td>.40+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem solving</td>
<td>.38+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsiveness w/</td>
<td></td>
<td></td>
<td>-.37+</td>
</tr>
<tr>
<td>Gross motor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encouragement w/</td>
<td></td>
<td></td>
<td>.36+</td>
</tr>
<tr>
<td>Fine motor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching w/</td>
<td></td>
<td></td>
<td>-.43+</td>
</tr>
<tr>
<td>Personal social</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* ASQ month form as a covariate.

* p ≤ .05.
+ p ≤ .10.
When constructs were positively correlated, mothers and infants could both be considered to be scoring high or low in their respective construct. When constructs were negatively correlated, mother and infant associations were in opposing directions such that as one score increased, the other decreased. Positive and negative correlations were sometimes demonstrated within different education categories, for instance with psychosocial resources and overall infant competence. For instance, mothers with some college displayed psychosocial resources that were higher when infant competence was lower and lower when infant developmental competence was higher. In contrast, mothers with a bachelor’s degree displayed psychosocial resources that matched their infant’s competencies, whether low or high.

Within the education category of some college, mothers with greater developmental knowledge had infants with lower fine motor and personal social competence. Mothers with lower psychosocial resources had infants with greater overall competence. Mothers with more affectionate interactions were more likely to have infants with greater fine motor, gross motor, and problem solving competence. Mothers who were more encouraging were likely to have infants with greater fine motor competence. More responsive mothers were likely to have infants with lower gross motor competence.

Mothers within the bachelor’s degree category showed several significant and trending-toward-significant correlations between constructs; all correlations were positive. This was the only education category with significant associations between overall parenting interaction and any other construct. Specifically, as mothers’ developmental knowledge increased or decreased, overall parenting interactions,
affection, and responsiveness increased or decreased in tandem. This was the only education category in which mothers’ parenting stress levels were associated with infants’ competence levels. Mothers who had more psychosocial resources had infants with greater overall infant competence, fine and gross motor competence, as well as problem solving competence.

Mothers within the post-bachelor’s degree category showed a different pattern of correlations amongst constructs compared to mothers with fewer years of education. Mothers’ income as measured by the two-level (but not three-level) categories increased or decreased together with infants’ communication competence. These suggest that mothers who interacted more affectionately had infants with lower gross motor competence and mothers who interacted less affectionately had greater gross motor competence. Mothers who used more teaching interactions had infants with lower personal social competence and mothers who used fewer teaching interactions had infants with higher social competence.

To summarize, within the three education categories there were distinctive patterns in associations among specific parent resources, parenting interaction domains, and child competence areas.

**Follow-Up Analyses for Income**

Categorizing by income category and controlling for ASQ month form version (4, 6, or 8) revealed differences between how the constructs were interrelated within each category. There were three income categories reported using the Federal Poverty Guidelines (FPG): poverty (≤100% FPG); low-income (101 to 200% FPG); and higher
income (≥201% FPG). In addition to this three-level category, the two lowest income groups were combined (≤200% FPG) into a two-level category to compare research literature that posits that children are similarly influenced by poverty and low-income status (e.g., Duncan et al., 2017). Table 12 shows both three- and two-level categories of income. The highest income category (≥201% FPG) contained the same participants

### Table 12

**Demographic Information in Two or Three Income Categories**

<table>
<thead>
<tr>
<th>Income (FPG)</th>
<th>Total (n)</th>
<th>Maternal age range (years)</th>
<th>ASQ 4-month form (n)</th>
<th>ASQ 6-month form (n)</th>
<th>ASQ 8-month form (n)</th>
<th>Infant has siblings (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Categories</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤100%</td>
<td>7</td>
<td>22-30</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>101-200%</td>
<td>35</td>
<td>22-39</td>
<td>15</td>
<td>15</td>
<td>5</td>
<td>26</td>
</tr>
<tr>
<td>≥201%</td>
<td>37</td>
<td>25-42</td>
<td>16</td>
<td>15</td>
<td>6</td>
<td>22</td>
</tr>
</tbody>
</table>

| 2 Categories |          |                            |                      |                      |                      |                        |
| ≤200%        | 42       | 22-39                      | 21                   | 16                   | 5                    | 27                     |
| ≥201%        | 37       | 25-42                      | 16                   | 15                   | 6                    | 22                     |

whether they were in the three-level category (Table 13) or the two-level category (shown later in Table 14) income configuration. Visual representations of significant and trending toward significant correlations within the income categories can be found in Appendix D.

Table 13 shows 15 significant and trending-toward-significant partial correlations represented within mothers’ three categories of income, controlling for ASQ form version. Only one construct pair, parenting stress and infant gross motor competency, was displayed by mothers within two income categories: ≤100% FPG, \( r(4) = -.79, p = \)
Within the ≤100% FPG category, eight construct pairs were significantly or trending-toward-significantly correlated. Mothers with more education had more parenting stress and infants who were trending toward less gross motor competence. Mothers with more developmental knowledge had infants with greater gross motor competence and trending-toward-less parenting stress. Mothers who were more

Table 13

*Partial Correlations Between Constructs, Three Income Categories*

<table>
<thead>
<tr>
<th>Constructs</th>
<th>≤100% FPG (n = 7)</th>
<th>101 to 200% FPG (n = 35)</th>
<th>≥201% FPG (n = 37)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal education w/ parenting stress</td>
<td>.94*</td>
<td>.32+</td>
<td>- .32+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>encouragement</td>
<td>.32+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>responsiveness</td>
<td>.30+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>communication</td>
<td>- .80+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>gross motor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developmental knowledge w/ gross motor</td>
<td>.82*</td>
<td></td>
<td>- .40*</td>
</tr>
<tr>
<td></td>
<td>problem solving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parenting stress w/ fine motor</td>
<td></td>
<td>.36*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>gross motor</td>
<td>-.79+</td>
<td>.35*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychosocial resources w/ responsiveness</td>
<td></td>
<td></td>
<td>.31+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affection w/ personal social</td>
<td>.80+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Table Continues)
responsive had infants with higher overall competence, fine motor, and problem-solving competence. Finally, mothers who interacted more affectionately had infants with more problem solving competence.

Within the low-income category, 101-200% FPG, three construct pairs were significantly or trending-toward-significantly correlated. Mothers with more education were more likely to have encouraging and responsive interactions with their infant. Mothers who had more developmental knowledge had infants with lower problem solving competence.

Within the highest income category, >201% FPG, four construct pairs were significantly or trending-toward-significantly correlated. Mothers’ parenting stress increased or decreased together with infants’ fine motor and gross motor competence. Mothers’ psychosocial resources increased or decreased together with responsive parenting interactions. Tables 13 and 14 have the same highest income category, >201% FPG, because the groups contain the same participants.
Table 14

*Partial Correlations Between Constructs, Two Income Levels*

<table>
<thead>
<tr>
<th>Constructs</th>
<th>≤200% FPG (n = 42)</th>
<th>≥201% FPG (n = 37)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal education w/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsiveness</td>
<td>.26+</td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>-.32+</td>
<td></td>
</tr>
<tr>
<td>Developmental knowledge w/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem solving</td>
<td>-.38**</td>
<td></td>
</tr>
<tr>
<td>Fine motor</td>
<td>-.28+</td>
<td></td>
</tr>
<tr>
<td>Parenting stress w/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine motor</td>
<td>.36*</td>
<td>.35*</td>
</tr>
<tr>
<td>Gross motor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychosocial resources w/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsiveness</td>
<td>.31+</td>
<td></td>
</tr>
<tr>
<td>Responsiveness w/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine motor</td>
<td>.26+</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Covaried by ASQ form version.

* p < .05.
+ p < .10.

When considered in two income categories, mothers in the lower income group, ≤200% FPG, showed four significantly or trending-toward-significantly correlated construct pairs. One of these is unique to this income category: mothers with more developmental knowledge had infants with less fine motor competence, $r(39) = -.28$, $p = .08$. The other three associations were similar in direction and strength of correlation to the original three-level categories considered separately: ≤100% and 101 – 200% FPG. Two correlations are nearly identical to the 101-200% FPG category: mothers’ education increased or decreased together with responsiveness to their infants; and mothers’ developmental knowledge increased or decreased in the opposite direction as infants’ problem solving and fine motor competence. One correlation is comparable to the ≤100%
category: mothers with greater responsive interactions had infants with greater fine motor competence.

To summarize, within the three- and two-level income categories, there were distinctive patterns in associations among specific parent resources, parenting interaction domains, and child competence areas.

Hypothesis 2

Hypothesis 2 proposed that mothers with more psychosocial parenting resources, reflected in more developmental knowledge and less parenting stress, would interact more supportively with their young infants. Similar to the approach with the previous hypothesis, data analysis for this hypothesis first examined the bivariate first-order correlations of mothers’ supportive interaction behaviors with their child development knowledge and parenting stress as separate independent variables, controlling for ASQ form (Table 15). The two psychosocial parenting resource indicators were not inter-related and did not significantly predict parenting interactions.

Next, the analyses examined the contribution of child development knowledge and parenting stress together in multiple regression analyses predicting mothers’ supportive interaction behaviors (Table 16), leading to similar results. Thus, psychosocial parenting resource variables were not related to the amount of supportive interactions mothers showed with their infants.
Table 15

*Regression Analysis for Predicting Parenting Interactions from Psychosocial Parenting Resources*

<table>
<thead>
<tr>
<th>Construct</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
</tr>
<tr>
<td>ASQ form version</td>
<td>-.13</td>
<td>.54</td>
</tr>
<tr>
<td>Developmental knowledge</td>
<td>.03</td>
<td>.14</td>
</tr>
<tr>
<td>Parenting stress</td>
<td>-.02</td>
<td>.12</td>
</tr>
</tbody>
</table>

*Note.* Model 2 $R^2 = .00$, n.s.

Table 16

*Regression Analysis for Predicting Parenting Interactions from Combined Psychosocial Parenting Resources*

<table>
<thead>
<tr>
<th>Construct</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
</tr>
<tr>
<td>ASQ form version</td>
<td>-.13</td>
<td>.54</td>
</tr>
<tr>
<td>Psychosocial parenting resources</td>
<td>.06</td>
<td>1.17</td>
</tr>
</tbody>
</table>

*Note.* Model 2 $R^2 = .00$, n.s.

**Hypothesis 3**

Hypothesis 3 proposed that mothers’ developmental knowledge would partially mediate the association between maternal education and supportive interaction behaviors with their young infants. Because of a lack of significant association between SES variables and parenting interactions, this hypothesis was not addressed using mediation analysis procedures.
Hypothesis 4

Hypothesis 4 proposed that parenting stress would partially mediate the association between family income and mothers’ supportive interaction behaviors with their young infants. Because of a lack of significant association between parenting resource variables and parenting interactions, this hypothesis was not addressed using mediation analysis procedures.

Hypothesis 5

Hypothesis 5 proposed that mothers’ supportive interaction behaviors would partially mediate the associations between mothers’ parenting resources and their infants’ developmental competence. Because parenting interactions were not significantly associated with infant competence, this hypothesis was not addressed using mediation analysis procedures.
CHAPTER V
DISCUSSION

Summary of Results

The first months of life provide the foundation for brain development in infants and children (Pace et al., 2017; Phillips & Shonkoff, 2000). Children’s individual developmental trajectories can be observed long before children enter school. To examine multiple facets of socioeconomic and psychosocial parenting resources as potential sources of influence on mother-infant interactions and young infant competence, this study brought together strands of research that are often reported separately. Maternal education and family income were investigated separately and combined into a socioeconomic status (SES) construct. Developmental knowledge and parenting stress were investigated separately and combined into a psychosocial parenting resources construct. In follow-up analyses, smaller categories of maternal education attainment and family income level were explored with psychosocial parenting resources, individual parenting interaction domains, and individual child development areas.

No statistically significant results were found in regard to the research questions. SES, psychosocial parenting resources, and infant competencies were not found to explain differences in parent interactions with their child. Follow-up analyses (not required for the dissertation) using SES-determined sample subsets and parenting interaction domains individually rather than in combination did reveal significant associations across subsamples separated into education and income categories.
Follow-Up Analyses

Follow-up analyses were conducted by separating larger constructs into their components to allow for further exploration of correlations between constructs. Socioeconomic and psychosocial parenting resources, parenting interaction domains, and infant competence were separated into their component categories following the logical separation points depending on the types of available data. These categories allowed for further exploratory investigation about how participants were similar or different according to a particular characteristic. For instance, separating education and income into categories that followed the data allowed identification of construct associations for mothers with similar and different levels of each SES indicator. Mothers in each education attainment category (some college, bachelors, and post-bachelors) were similar to each other and different from mothers within the other education attainment categories. Similarly, mothers in each family income category were similar to each other and different from mothers at other levels. Using the education and income level categories to explore parenting interaction and infant competence both as whole measures and as separate domains or areas revealed patterns that were not previously apparent. The follow-up analyses provided guidance for future studies but were limited due to low power and uneven sample sizes within subgroups.

Interpretation of Results

In the present study, socioeconomic and psychosocial parenting resources were not associated with total parenting interaction measure score except for a small
subsample at the poverty level. By separating SES into maternal education and family income, it was easier to tease apart the critical factor of relatively high maternal education rather from the more commonly addressed risk of poverty-level family income. While these findings matched the original PICCOLO sample of parents who were in poverty at the time of recruitment (Roggman et al., 2013b) in that only the lowest income level group showed significant associations between parenting resources and parenting interactions, but the direction of association was opposite of the original PICCOLO sample. This may be because the sample used for this study was highly educated even if they met the federal definition of poverty status. These mothers may have been similar to highly educated mothers from the American Time Use survey who decided to invest in their children by spending more caregiving time with them rather than putting them into another person’s care (Kalil et al., 2012).

**SES Resources and Parenting Interactions**

Education and income were significantly associated with each other but neither, whether considered separately or combined into a single indicator, was significantly associated with parenting interaction behaviors. This finding was surprising given the decades of research showing that SES influences parenting. Separating mothers’ data into SES groups provided more insight into patterns. According to the literature, middle SES mothers tend to talk with their children using conversational exchanges and greater number and complexity of language, while lower SES mothers are more likely to provide short directive, controlling phrases intended to ensure child compliance—different communication strategies that establish different social interaction expectations and
patterns for children (Hart & Risley, 1995, 2003). Outside of extreme poverty, maternal education appears to be the component of SES most strongly related to parenting measures (Bornstein et al., 2013; Hoff, 2003). Maternal education is a less transitory measure of SES than income (Bornstein & Bradley, 2003; Raver, Blair, & Willoughby, 2013). For this highly educated and all-married sample, even mothers in poverty were likely to have social resources to prevent stress experienced by mothers in higher risk situations.

Although maternal education was not significantly associated with the entire parenting interaction measure of all domains considered together, it was significantly associated with one separate domain: responsiveness. The connection between maternal education and responsiveness is similar to other studies (Magnuson et al., 2009). Mothers with more education are more likely to be verbally responsive, to use teaching strategies more often, and to model formal instructional techniques rather than using verbal directives (Hoff-Ginsberg, 1991; Richman, Miller, & LeVine, 1992; Tracey & Young, 2002). Mothers’ consistent, contingent responsiveness to infants’ cues teaches infants to expect similar interactions from others (Guttentag et al., 2014). This supports the transactional nature of the relationship in which infants can guide interactions and trust their mother to respond rather than just waiting for their mother to make all of the interaction initiations. This can build relationship communication as each learns to recognize and meet the other’s needs and interests. Mothers can also use these interactions as a mechanism to expand infant emotional regulation and attention as well as to teach infants about the environment and tools for developing into an increasingly
advanced member of their social culture.

Family income was not significantly associated with the overall parenting interaction measure, nor was it associated with any of the individual parenting interaction domains. This was unexpected due to prevalence of studies reporting that family income level is an important influence on current and intergenerational parenting interactions, especially at lower income levels (Duncan et al., 2017). However, because all mothers were married, it was possible that their families chose to live with lower levels of income to allow the mother to stay home with her infant.

In the current sample, just over half of the families were below 200% of the Federal Poverty Guideline, a defining threshold of low-income status. All mothers were married and there was a low percentage of families in poverty. Although lower SES families may lack access to various life necessities or cultural assets if using their own financial resources, they are more likely to qualify for subsidies and state or federal aid that enable them to access resources as if they were not low income. Many mothers in this study’s under 200% FPG-income group reported receiving government assistance such as the Women, Infants, and Children (WIC) supplemental nutrition program. Their ability to access WIC and other social supports suggests that these mothers were resourceful at getting their needs met (Liu & Liu, 2016) and less worried about stigma of participating in a government subsidy compared to many women of low-income status in the U.S. (Powell, Amsbary, & Xin, 2015).
Psychosocial Parenting Resources and Parenting Interactions

Psychosocial parenting resources of developmental knowledge and parenting stress were not associated with developmentally supportive parenting interactions, either in the overall measure or in specific domains for the whole sample. This was surprising given the support for these measures and parenting interactions in the literature (Hess, Teti, & Hussey-Gardner, 2004; Huang, Caughy, Genevro, & Miller, 2005; Rowe, 2008; Rowe et al., 2016).

Considering different levels of education attainment revealed that mothers with bachelor’s degrees, but not mothers with some college or post-bachelor’s degrees, had parenting interactions that were most associated with psychosocial resources. The education delineation of the significant associations was true whether considering developmental knowledge, parenting stress, or a combined psychosocial resource construct. Perhaps mothers with lower levels of education did not consider or know where to seek information or were not as stressed about infant development. In addition, perhaps mothers with slightly more education were more concerned about their child’s development whereas mothers with a lot more education were, as a group, more diverse in their parenting experience or child rearing concerns and priorities. Lareau’s (2003) findings that lower and higher SES families and parenting expectations indicated that lower SES parents tend to allow children’s development to unfold in a natural growth approach whereas higher SES parents tend to actively manage their children’s experiences using a concerted cultivation approach. Perhaps this has a different effect with parents of young infants.
Developmental knowledge is often considered a key component of how parents approach their parenting role, how they make day-to-day decisions about parenting, what they expect from their children at different ages, how they play with their infants, and how they gauge their own performance (Bornstein & Tamis-LeMonda, 2010; Damast et al., 1996; MacPhee, 1983). Developmental knowledge was positively associated with infant competence for mothers who were in poverty, middle income, and combined lower income group but not the highest income group of families over 200% of the Federal Poverty Guideline. Parenting stress had a differential effect on different income groups. It was negatively associated with infant competence for groups in poverty but positively associated with infant competence for higher income groups.

Caregivers with adequate child development knowledge may also have had barriers in their lives that interfered with them using that knowledge when providing caring for their infant (Hess et al., 2004). Mothers’ higher education levels have been shown to be associated with greater developmental knowledge (Reich, 2005) so it is not surprising that this highly educated sample of mothers also had high levels of developmental knowledge.

All mothers reported some parenting stress but none was highly stressed. Perhaps this was due to the nature of recruitment where participants agreed to join the study without compensation, but instead to learn about their child’s development and to get a video of themselves playing with their child; mothers with high parenting stress and poor parenting interactions may have been unwilling to volunteer for this study. In a higher risk sample with increased general stress or strained family functioning, parenting stress
may have been more likely and important to consider (Chang & Fine, 2007; Smith, Oliver, & Innocenti, 2001). Parenting stress and low-income status, along with other sources of chronic stress, are barriers that can interfere with supportive parenting interactions (Coyl et al., 2002; Garrett-Peters et al., 2008; McLoyd, 1998).

Potential Mediation

In this study, parenting interaction behaviors, overall, were not associated with SES resources, and therefore, there were no associations for parenting resources to mediate. Previous studies have found that parenting interactions mediate income’s effects on children, but many of these studies are on elementary age children rather than infants (Gershoff et al., 2007). In this sample, the complete parenting interaction measure was not related to either SES or psychosocial resources, and neither of these were related to infant competencies, so the conditions for testing mediation were not met. Therefore, hypotheses related to mediation were not tested.

Limitations

The limitations for this study fall into two main categories: sample characteristics and data. These limitations indicate that generalizations from this study should be made carefully. Even though the size of the whole sample met minimum recommendations, it was small enough that the power of this study to identify reliable patterns in the data was potentially limited. Most of the significant findings were revealed when using subsamples that did not meet the original sample size recommendations. This was a convenience sample with a range of recruitment avenues including word of mouth, doctor’s offices,
social media, and flyers. This was a homogenous sample even though it was collected in multiple states in the Intermountain West. The majority of participants were Caucasian, lived near a university, were highly educated, and were comfortable with university research protocols. All participants were married. Even though three levels of education were represented, all were at the high end of the range and there was not enough variability to fully investigate the education portion of the research questions. There was a wide span of infant ages inconsistently distributed across many weeks which means that the sample of infants represented many different developmental stages with different numbers of infants in each age stage. It would have helped to have infants evenly distributed across age stages with smaller ranges.

The second category of limitations pertain to characteristics of data provided by the extant data set. Rather than being longitudinal, data were collected during a single short visit resulting in concurrent data. Information was not requested that would have indicated mothers’ level of contextual stress that could be compared to the reported parenting stress. Two aspects of the SES indicators provided limitations to analyses. The first was the collection of income and education in the format of grouped options rather than as a sequential list of numbers that could be analyzed as continuous data with a realistic range. Data about parenting interactions were based on a measure developed and validated with infants older than 10 months, so validity of the measure has not been established with infants in the age range in this sample. The second was the provision of only family income and maternal education rather than collecting a set of SES information that would have accounted for parents’ occupation and allowed for the
comparison of a large body of previously published literature that used a single composite SES score such as Hollingshead’s Four Factor Index (1975).

**Future Directions**

Future research could replicate and extend this study with a few improved aspects. Having a larger, randomly selected sample would strengthen this study. There would more power to detect any findings and the results would be more likely to be generalizable. Purposive sampling to ensure a large enough representation of each infant age would allow more consideration of the effects of infant age which could provide insight into whether parents interact differently with younger versus older infants within the first nine months. Purposive sampling to ensure enough representation for parents from different levels of education and income and other relevant SES variables would help address the inconsistency between this study and the current research literature indicating different infant development trajectories associated with lower SES families.

This research could also be extended by reviewing and improving data collection measures as needed. The Parent Information Questionnaire could use SES questions that are more specific. First, replacing the grouped education and income variables with either smaller categories or fill-in-the-blank spaces for parents to enter their income would provide more robust data for data analysis. Second, asking for information about the specific government aid received (e.g., Women, Infants, and Children; Supplemental Nutrition Access Program; subsidized housing, etc.) would provide more specific information about each family’s SES beyond their income. Third, future studies could
test the full- rather than short-form of Knowledge of Infant Development Index, and if feasible, an additional measure of parent’s developmental knowledge, such as the one created and currently being tested by Suskind and team’s (2017b) Thirty Million Words Initiative project, could be compared with the KIDI.

Using the current data from the HOPED project will provide multiple avenues for contributing to the field and guiding future research. Looking ahead on the HOPED project, comparing first- and second-visit data will be helpful to explore potential predictive capabilities of PICCOLO+B to the original PICCOLO with the same mother-infant dyads. The data in this dissertation, along with the literature review, can be used separately or in combination with findings from other projects, to support publication of the PICCOLO+B measure. Further investigation into each measure at the item-level may provide guidance into whether infants, mothers, and families with different demographic characteristics may be more accurately assessed and described by using different combinations of data collection.

**Conclusions**

In conclusion, family income, maternal education, developmental knowledge, and parenting stress have been shown to influence parenting interaction behaviors in previous literature. However, in this highly educated sample, variations in these SES and parenting resources did not seem to influence parenting interaction behaviors, which did not seem to influence child competencies. Follow-up analyses that segmented the whole sample into parts by maternal education and family income and broke overall parenting
interaction and infant competency measures into domains and areas provided more information about this sample. Future studies of parenting with young infants should consider more purposive sampling, a larger sample enabling consideration of the whole group as well as smaller groups of different SES levels and parenting interaction and infant competencies, and multiple short data collection sessions to provide a better understanding of the pathways from parenting resources to parenting interactions to infant competencies.
REFERENCES


Hollingshead, A. A. (1975). *Four-factor index of social status*. Unpublished manuscript, Yale University, New Haven, CT.


APPENDICES
Appendix A

Home Observation of Parenting and Early Development:
Parent Information Questionnaire
Parent Information Questionnaire

Thank you for helping us understand how parents interact with their infants and balance parenting with other aspects of their lives. Please fill in the blank or circle the most accurate answer for each question.

1. How did you hear about this project?
   □ 1. Invitation from a researcher
   □ 2. Invitation from friend, relative or community person
   □ 3. Flyer in the community or on campus
   □ 4. Announcement in community or in a class
   □ 5. Internet (Facebook, KSL.com, Craigslist)
   □ 6. Other: ____________

2. Do you have friends or family with a baby under 10 months old?
   □ 0. No
   □ 1. Yes

3. Would you tell someone else with a young baby about the opportunity to participate in this project?
   □ 0. No
   □ 1. Yes
   □ 2. Maybe

4. What is your local zip code? ____________

5. What is your age in years?
   (rounded to nearest year, 17.5 - 18): ____________

6. What is the highest level of education you have completed?
   □ 1. 11th-12th grade
   □ 2. 9th-10th grade
   □ 3. High School graduate
   □ 4. GED
   □ 5. Some college or Vocational School
   □ 6. Graduated Bachelor's
   □ 7. Graduated Master's or other post-graduate degree

7. Relationship to infant:
   □ 1. Mother biological
   □ 2. Father biological
   □ 3. Other (e.g. stepmother, foster mother) ____________

8. What is your relationship status?
   □ 1. Married
   □ 2. Living with partner
   □ 3. Single never married, divorced, or widowed

9. What is your living situation?
   □ 1. Living with spouse or partner
   □ 2. Living with other adults (not a spouse or partner)
   □ 3. Living alone with child(ren)

10. How many older siblings does your baby have? ____________

11. Are you currently employed?
    □ 0. No, I'm not employed
    □ 1. Yes, 1-10 hours/wk
    □ 2. Yes, 11-20 hours/wk
    □ 3. Yes, 21-29 hours/wk
    □ 4. Yes, 30+ hours/wk

12. Using the income chart select:
    □ A. ____________
    □ B. ____________
    □ C. ____________

13. Do you receive funds or other resources from WIC/SNAP/TANF or other from Department of Workforce Services?
    □ 0. No
    □ 1. Yes

14. Do you volunteer?
    □ 0. No, I don't do volunteer work
    □ 1. Yes, 1-10 hours/wk
    □ 2. Yes, 11-20 hours/wk
    □ 3. Yes, 21-29 hours/wk
    □ 4. Yes, 30+ hours/wk

15. How many hours a week is your child cared for by someone other than you?
    □ 0. None, I am always with my child
    □ 1. 1-10 hours/wk
    □ 2. 11-20 hours/wk
    □ 3. 21-29 hours/wk
    □ 4. 30+ hours/wk

16. Who most often takes care of your child for 10 or more hours a week besides you (select up to 3)?
    □ 0. No one other than you
    □ 1. Child's other parent
    □ 2. Child's grandparent
    □ 3. Other relative
    □ 4. In-home childcare, unlicensed
    □ 5. In-home childcare, licensed
    □ 6. Childcare center
    □ 7. Preschool, education center, or lab school
    □ 8. Neighbor or friend

17. How many months old is your child today? ____________ (rounded to nearest whole month)

18. Is your baby a
    □ 0. Boy
    □ 1. Girl

19. Was your baby born full term (39+ weeks)?
    □ 0. No
    □ 1. Yes

20. Were there any complications with the pregnancy or delivery?
    □ 0. No
    □ 1. Yes

21. Are you enrolled in school or a training program? If yes, how many hours do you typically spend attending class and studying?
    □ 0. No, I'm not enrolled in school or training
    □ 1. Yes, 1-10 hours/wk
    □ 2. Yes, 11-20 hours/wk
    □ 3. Yes, 21-29 hours/wk
    □ 4. Yes, 30+ hours/wk

COMPLETE REVERSE SIDE IF YOU ARE A STUDENT PARENT
Fill out questions 22-31 if you are a student parent

22. What school do you attend? _____
   1. Utah State University
   2. Bridgerland Applied Technology College
   3. Weber State University
   4. High school
   5. Other __________________________

23. What year of school are you in?
   ___ 1. Freshman (first year)
   ___ 2. Sophomore (2nd year)
   ___ 3. Junior (3rd year)
   ___ 4. Senior (4th or 5th year)
   ___ 5. Graduate (after Bachelor’s degree)
   ___ 6. Certificate program

24. How many credits are you currently enrolled in? _____

25. What is your major/minor? ________________________________

26. Do you receive financial aid for school?
   ___ 0. No
   ___ 1. Yes

27. Do you receive scholarships?
   ___ 0. No
   ___ 1. Yes

28. Do you receive other funds or other resources for your education/training?
   ___ 0. No
   ___ 1. Yes

29. Have you recently taken a leave of absence or paused your education due to having a baby?
   ___ 0. No
   ___ 1. Yes

30. Have your baby’s healthcare needs caused you to miss any time from school?
   ___ 0. No
   ___ 1. Yes

31. Do you have friends or family who are parenting a baby under 10 months old while attending school?
   ___ 0. No
   ___ 1. Yes
Appendix B

Home Observation of Parenting and Early Development:
Income Guide
Use either the annual or monthly chart. Find your family size and income. Write A, B, or C as your answer for question 12.

### Annual Gross Income

<table>
<thead>
<tr>
<th>Family Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>&lt; 15,510.00</td>
<td>15,510.00 - 31,020.00</td>
<td>&gt; 31,020.00</td>
</tr>
<tr>
<td>3</td>
<td>&lt; 19,530.00</td>
<td>19,530.00 - 39,060.00</td>
<td>&gt; 39,060.00</td>
</tr>
<tr>
<td>4</td>
<td>&lt; 23,550.00</td>
<td>23,550.00 - 47,100.00</td>
<td>&gt; 47,100.00</td>
</tr>
<tr>
<td>5</td>
<td>&lt; 27,570.00</td>
<td>27,570.00 - 55,140.00</td>
<td>&gt; 55,140.00</td>
</tr>
<tr>
<td>6</td>
<td>&lt; 31,590.00</td>
<td>31,590.00 - 65,180.00</td>
<td>&gt; 65,180.00</td>
</tr>
<tr>
<td>7</td>
<td>&lt; 35,610.00</td>
<td>35,610.00 - 71,220.00</td>
<td>&gt; 71,220.00</td>
</tr>
<tr>
<td>8</td>
<td>&lt; 39,630.00</td>
<td>39,630.00 - 79,260.00</td>
<td>&gt; 79,260.00</td>
</tr>
</tbody>
</table>

### Monthly Gross Income

<table>
<thead>
<tr>
<th>Family Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>&lt; 1,292.50</td>
<td>1,292.50 - 2,585.00</td>
<td>&gt; 2,585.00</td>
</tr>
<tr>
<td>3</td>
<td>&lt; 1,627.50</td>
<td>1,627.50 - 3,255.00</td>
<td>&gt; 3,255.00</td>
</tr>
<tr>
<td>4</td>
<td>&lt; 1,962.50</td>
<td>1,962.50 - 3,925.00</td>
<td>&gt; 3,925.00</td>
</tr>
<tr>
<td>5</td>
<td>&lt; 2,297.50</td>
<td>2,297.50 - 4,595.00</td>
<td>&gt; 4,595.00</td>
</tr>
<tr>
<td>6</td>
<td>&lt; 2,632.50</td>
<td>2,632.50 - 5,265.00</td>
<td>&gt; 5,265.00</td>
</tr>
<tr>
<td>7</td>
<td>&lt; 2,967.50</td>
<td>2,967.50 - 5,935.00</td>
<td>&gt; 5,935.00</td>
</tr>
<tr>
<td>8</td>
<td>&lt; 3,302.50</td>
<td>3,302.50 - 6,605.00</td>
<td>&gt; 6,605.00</td>
</tr>
</tbody>
</table>

**Income includes:**
- Money wages or salary BEFORE deductions
- Social Security, Rail Retirement, Private or Government pensions (including military retirement pay)
- Unemployment compensation
- Strike benefits from Union Funds
- Worker’s Compensation
- Veteran’s benefits
- Public Assistance (including TANF, SSI, emergency assistance money payments)
- Training Stipends
- Alimony and Child support
- Military family allotments or other regular support from an absent family member
- Regular insurance or annuity payments
- College or University scholarships, grants, fellowships and assistantships
- Dividends, interest and periodic receipts for Estate or Trust
- Net income (gross receipts minus operating expenses), from self-employment, farm self-employment, rental income, royalties, gambling, or lottery winnings

**Income does NOT include:**
- Capital gains
- Assets drawn down as withdrawals from a bank
- Sales of property, house or car
- Tax refunds, gifts, loans, lump-sum inheritances, one time insurance payments or compensation for injury
- Employer paid or union paid portion of health insurance or other fringe benefits
- Food or housing in lieu of wages, value of food & fuel produced and consumed on farms
- The imputed value of rent from owner-occupied, non-farm or farm housing
- Federal non-cash benefits: Medicare, Medicaid, Food stamps, School Lunches, Housing Assistance
Appendix C

PICCOLO: 29 Things Parents Do That Predict School Readiness
29 THINGS PARENTS DO THAT PREDICT SCHOOL READINESS

Below are 29 things parents do with their young children, ages 10-17 months, that predict one or more of the following outcomes when children are old enough to start kindergarten:

Cognitive skills (problem solving, reasoning, science, and math readiness)

Vocabulary (word knowledge, language ability)

Literacy skills (recognizing letters, linking speech sounds to letters, recognizing text)

Social skills (emotional regulation, low rates of aggression)

Our research, on over 4,000 observations of almost 2,000 families, shows that very few parents do all of these things, but all parents do some of these things. And the more parents do these things, the better their children do on school readiness assessments. PICCOLO™ is an observational measure of these behaviors.

1. Speak warmly
2. Smile at child
3. Praise child
4. Stay physically close to child
5. Say positive things to child
6. Interact in positive ways with child
7. Show emotional warmth
8. Pay attention to what child is doing
9. Change activities to meet child's interests or needs
10. Be flexible when child changes interests
11. Follow what child is trying to do
12. Respond to child's emotions
13. Look at child when child talks or makes sounds
14. Reply to child's words or sounds
15. Wait for child's response after making a suggestion
16. Encourage child to do things with toys
17. Support child's choices
18. Help child do things on his or her own
19. Verbally encourage child's efforts
20. Offer suggestions to help child
21. Show enthusiasm about what child does
22. Explain reasons for something to child
23. Suggest activities to build on what child is doing
24. Repeat or expand child's words or sounds
25. Label objects or actions for child
26. Engage in pretend play with child
27. Do activities in a sequence of steps
28. Talk about characteristics of objects
29. Ask child for information

Text adapted by permission from Parenting Interactions with Children: Checklist of Observations Linked to Outcomes (PICCOLO™) Tool by Lenci, S., Bemben, G., Cook, M., & Newman, V. © 2013 by Paul H. Brookes Publishing Co., Inc. All rights reserved.

Find out more about the PICCOLO observational tool! Call 1-800-638-3775 or visit www.brookespublishing.com

PICCOLO™ and PICCOLO are trademarks of Paul H. Brookes Publishing Co., Inc.
Appendix D

Visual Display of Correlations between Constructs Comparing Families at Different Income Levels
Figure D1. Significantly and trending toward significantly correlated constructs for mother-infant dyads reporting under 101% Federal Poverty Guideline income (Covaried with ASQ form version).
Figure D2. Significantly and trending toward significantly correlated constructs for mother-infant dyads reporting 101 to 200% Federal Poverty Guideline income (covaried with ASQ month form).
Figure D3. Significantly and trending toward significantly correlated constructs for mother-infant dyads reporting under 201% Federal Poverty Guideline (income group created by combining < 100% FPG and 101-200% FPG groups; covaried with ASQ form version).
Figure D4. Significantly and trending toward significantly correlated constructs for mother-infant dyads reporting over 201% Federal Poverty Guideline (covaried with ASQ form version).
CURRICULUM VITAE

KRISTA L. GURKO

EDUCATION

Utah State University; Logan, UT
Dissertation: Socioeconomic status influence on mothers’ interactions with infants: Contributions to early infant development

University of Washington; Seattle, WA
Thesis: A case study approach to understanding the experience of an Asian immigrant parent of a child with autism

B.A. Comparative History of Ideas (2002)
University of Washington; Seattle, WA
Thesis: Public policy implications of acknowledging the emotional needs of infants and their mothers

RESEARCH & PROFESSIONAL EXPERIENCE

Utah State University

Analyst 11/2017 - present

Research & Graduate Studies
Create, disseminate, analyze, and report survey data to improve graduate student recruitment services and university research services. Collaborate on coordinating and executing recruitment and research events.

Program Coordinator 08/2015 - present

Home Observation of Parenting and Early Development
Follow Institutional Review Board (IRB) approved protocols to develop research protocols for longitudinal data collection, management, analysis and reporting. Recruit, train and manage researchers.

Program Coordinator 07/2014 - 11/2016

AmeriCorps: Volunteers In Service To America (VISTA) with Public & School Partnership
Guided service members to conduct and review site-specific needs assessments for education and data-tracking services for teachers, counselors, students and parents. Recruited, hired, trained, reviewed performance and provided sensitive corrective guidance for members. Prepared for and passed federal grant intensive records audit. Supported member-led events. Tracked and logged purchases in university financial tracking systems. Organized project financial record sheets and met monthly with business officers to ensure compliance. Represented VISTA at university, Service Learning and National Service meetings and conferences. Modified system-wide protocols and training materials in response to grant requirement changes. Developed online and in-person group and individualized training modules to promote partner school program success and member
professional development through sustained motivation and accurate monthly data reporting. Worked with multiple school districts, nonprofit organizations and federal grant administrators to ensure compliance and effective service delivery by coaching national service members to create programs and materials to support student academic and behavioral success.

**Director**
04/2016 - 11/2016

**Senior Corps: Retired & Senior Volunteer Program (RSVP) with Public & School Partnership**
Worked with school principals and nonprofit center directors to establish and maintain partnerships for volunteer placements following Memorandum of Understanding contracts. Received and implemented training on federal grants, including Office of Management and Budget Circulars and online federal grant reporting systems. Coordinated with university Sponsored Programs and IT departments to ensure program compliance with federal and university regulations. Represented RSVP at university, Service Learning and National Service meetings and conferences.

**Graduate Research Assistant** 05/2013 - 07/2014

**Utah State University Science Technology Arithmetic and Reading: Students Gaining Early Awareness and Readiness for Undergraduate Programming (USU STARS! GEAR UP)**
Liaised between external evaluation team and multiple public and charter schools to ensure adherence to federal grant guidelines for serving school staff and underrepresented students and parents. Implemented protocols, developed training materials, facilitated training events and maintained consistent communication with school staff to support accurate and consistent reporting. Created and administered surveys, managed data and wrote summary reports incorporating community partner feedback. Oversaw a research study assessing student and teacher experience of Space Dynamics Lab materials, study design, IRB submission and obtaining school administration consent. Represented GEAR UP at College Access Network state meetings and teacher professional development events.

**Graduate Research Assistant** 10/2013 - 07/2014

**Department of Instructional Technology and Learning Sciences, Active Learning Lab at Utah State University**
Used pre- and post- surveys to collect data on teacher professional development trainings. Created qualitative coding schemes to analyze data, used findings to generate sections of grant-required reports and assisted in preparing conference presentation materials.

**Graduate Research Assistant** 08/2011 - 05/2013

**Child Care Resource and Referral, Bridgerland Region at Utah State University**
Worked with the Principal Investigator, Child Care Resource and Referral staff and Utah Office of Child Care personnel to create interview and survey protocols. Conducted focus group interviews and administered surveys to gather stakeholder perceptions of Utah’s initiation of the online child care Quality Recognition and Information System. Analyzed stakeholder responses and followed Implementation Science principles when creating technical papers and providing recommendations for the Utah Office of Child Care. Mentored undergraduates in research practices including IRB requirements, creating surveys and respectfully studying vulnerable populations.

**Community Research and Work Experience**

**Family Support Specialist** 08/2008 - 08/2009

**Navos Mental Health Solutions, Seattle, WA**
Conducted in-home assessments of child development and parent-child relationships to inform interventions and court reporting of the therapeutic research project. Guided parent navigation of state systems. Wrote progress reports for court records of placement decisions for children in foster care.
Volunteer Coordinator 01/2008 – 10/2008
Interra Project, Seattle, WA
Recruited and trained volunteers for this nonprofit-business partnership’s coordinated donation service. Created volunteer training materials and trained volunteers to provide outreach in local businesses and community fairs. Coordinated internship training and experience for a university international nonprofit studies program.

University of Washington
Research Coordinator 08/2006 - 09/2008
Barnard Center for Infant Mental Health and Development
Collaborated with state agencies including the Department of Social and Health Services to conduct home visits with parents and young children in state care. Worked independently and with PI to develop protocols for recruitment, assessment, interviewing, data security and quantitative and qualitative data analysis. Trained and managed research assistants with child assessments, interview techniques and data coding.

Barnard Center for Infant Mental Health and Development, Professor Sheri Hill
Wrote and distributed meeting minutes and policy briefs, coordinated children’s justice outreach events.

Experimental Education Unit
Created qualitative coding system for parent survey responses about their experience of having a child with autism attending an integrated lab school.

TEACHING
Utah State University
Graduate Instructor 08/2011 - 05/2013
(30-175 students)
Child Development and Parenting (FCHD 2610)
Lifespan Development (FCHD 1500)

Brazilian Teacher Education 06/2010 - 08/2010
(10-20 school staff)
Prepared and co-taught teaching staff about classroom use of National Library of Virtual Manipulatives to connect lessons to Brazilian national curriculum while on an exchange program with the Fund for the Improvement of Postsecondary Education grant through Utah State University.

University of Washington, Experimental Education Unit
Teaching Assistant 09/2005 - 08/2007
(Between 15-30 students)
Prepared and taught lessons to preschool and kindergarten students with and without disabilities. Used assessments and Individualized Education Plan goals to guide individualized instruction.
GRANTS
Co-wrote and was awarded a $51,000 federal grant from the Corporation for National and Community Service (CNCS) to initiate a program where senior citizen volunteers supported student learning in P-12 schools and nonprofit organizations.
Wrote and was awarded a $3,500 supplemental grant from CNCS for project expenses.

PUBLICATIONS

Journal Publications

Electronic Publications

Posters & Presentations
Hill, A., Gurko, K., Olson, T., & Roggman, L. (03/2014). Home visiting as parent mentoring: Parallel developmental relationships. Poster Presentation: Mentoring Institute at University of New Mexico. Albuquerque, NM.
Gurko, K. (04/2011). What does LORI say? Comparing the availability and characteristics of


Technical Papers


INVITED SPEAKER

04/2014 The International Ecotourism Society’s Ecotourism and Sustainable Tourism Conference “World Cup of Ecotourism”: Bonito, Brazil. Presented full day workshop for K-12 teachers about ecotourism principles of multicultural interactions emphasizing family and community wellbeing during events.

INVITED REVIEWER

2012 Infancy, the journal of the International Congress of Infant Studies
2012 National Association for the Education of Young Children
2012 Society for Research and Human Development Conference Posters

PROFESSIONAL MEMBERSHIPS

2017 - present Toastmasters International, Logan Chapter
2015 - present Zero To Three National Training Institute
2015 - present World Association of Infant Mental Health
2011 - 2013 National Association for the Education of Young Children
2010 - 2012 USU Society for the Advancement of Qualitative Studies – Student Coordinator
2011 - 2012 Association for Childhood Education International
SERVICE

2017 - present  Stokes Nature Center in Logan, UT – Development Committee
2015 - present  Public & School Partnership at Utah State University – Advisory Board
2011 - 2017   Phi Upsilon Omicron Honors Society at USU – Vice President (rotated roles)
2014 - 2016   Utah Physics Day – Judge
2014          The International Ecotourism Society – Volunteer Coordinator
2012          Society for Research and Human Development Conference – Poster Reviewer