MASTER'S THESIS OF HUMAN ECOLOGY

The relationship between temperament and self-initiative behavior among preschoolers: The mediational role of cortisol reactivity

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FEBRUARY 2018

DEPARTMENT OF CHILD DEVELOPMENT AND FAMILY STUDIES
THE GRADUATE SCHOOL
SEOUL NATIONAL UNIVERSITY

The relationship between temperament and self-initiative behavior among preschoolers: The mediational role of cortisol reactivity

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이 논문을 생활과학석사 학위논문으로 제출함
2017년 5월

서울대학교 대학원
아동가족학과
은 선 민

은선민의 석사 학위논문을 인준함
2017년 6월

위 원 장 _____ (인)

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위 원 _____ (인)

ABSTRACT

The present study focused on preschoolers' self-initiative behavior as a developmentally salient competency that leads to adaptive performance in social challenges. In particular, the study aimed to investigate the role of cortisol reactivity as a physiological mediator between preschoolers' temperamental characteristics and self-initiative behavior shown in classroom environment. The following research questions were addressed:

1. Is there a correlation among temperament (extraversion, negative affectivity, effortful control), cortisol reactivity, and self-initiative behavior (goal-setting, self-practice, self-control) among 5-year-old preschoolers?

2. Does temperament (extraversion, negative affectivity, effortful control) affect cortisol reactivity and self-initiative behavior of 5-year-old preschoolers?
   1) Does temperament (extraversion, negative affectivity, effortful control) affect cortisol reactivity of 5-year-old preschoolers?
   2) Does temperament (extraversion, negative affectivity, effortful control) affect self-initiative behavior of 5-year-old preschoolers?

3. Does cortisol reactivity have mediating effects on the association between temperament (extraversion, negative affectivity, effortful control) and self-initiative behavior among 5-year-old preschoolers?

Participants of this study were 5-year-old preschoolers (N = 125) and their teachers (N = 13), recruited from childcare centers and kindergartens located in Seoul, Daegu, and Kyungi province of the Republic of Korea. Collected data was analyzed using the statistical analysis program, SPSS 22.0, and the following conclusions were drawn based on the major findings.

First, among the 3 dimensions of temperament, extraversion and negative affectivity displayed significant negative correlations to self-initiative behavior, whereas effortful control demonstrated a significant positive correlation with it. In the relationship between temperament and cortisol reactivity, only negative affectivity showed a significant correlation. A significant positive correlation was revealed in association between cortisol reactivity and self-initiative behavior.

Second, among the 3 dimensions of temperament, negative affectivity directly influenced preschoolers' cortisol reactivity and self-initiative behavior when child sex and birth order variables were controlled for.

Third, preschoolers' cortisol reactivity was found to partially mediate the association between temperamental negative affectivity and self-initiative behavior.

The current study investigated a structural relationship among 5-year-old preschoolers' temperament, cortisol reactivity and self-initiative behavior. Results revealed that individual variations in children' temperament differentiate physiological stress responsivity, which ultimately function to shape differential execution of self-initiative behavior. Specifically, stronger tendencies toward negative affects in preschoolers lower the physiological responsivity through diminished cortisol reactivity, and the declined responsivity

subsequently reduces the display of self-initiative behavior. This research proposes a positive perspective on the activation of the stress response system with further exploration of the beneficial effects of such characteristics on preschoolers' self-initiative behavior.

Keywords: self-initiative behavior, temperament, negative affectivity, cortisol reactivity, physiological stress response

Student Number: 2014-22905

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I. Introduction

The OECD proposed three generic key competencies necessary for individuals to build a successful life and a functioning society by implementing the Definition and Selection of Competencies (DeSeCo) project (OECD, 2005). Among the identified competencies, "Act autonomously and reflectively," is garnering attention as a developmentally salient, adaptive attribute required in this day and age. For example, the focus of education has shifted from the pedagogical environment of learning to one that highlights learning as a self-initiated process, guided by students' own abilities. Likewise, organizations have identified employees' proactive behavior as the core talent required in the working environment. Thus, in today's ever-changing society which demands its members to adapt to ongoing changes, individuals with the capacity for autonomous action are sought after.

The ability to autonomously initiate and regulate one's own behavior is required from preschool years. With the increase in women's labor-force participation, the entry age into child care institutions has been significantly lowered, yielding more responsibility to children to take care of themselves and to solve problems on their own from an earlier age. The classroom context, where incidents of various attempts, conflicts, cooperation, compromises, and compliances are made, is likely to act as a source of social stress for preschoolers (Rimm-Kaufman & Pianta, 2000). However, such circumstances do not invariably affect all children in the same way. Even with exposure to identical stimuli and stressors, some children are affected relatively more than others, while some even achieve optimal outcomes by responding flexibly and adaptively (Belsky,

Bakermans-Kranenburg, & Van IJzendoorn, 2007). In this regard, the present study focuses on self-initiative behavior of young children as a core competency at the individual level that leads to better adjustment in a novel, socially challenging environment.

The concept of 'self-initiative' originated from the studies of 'initiative', which generally is defined as a major developmental task in early childhood. With an application of agentic perspectives from the social cognitive theory (Bandura, 1989; 2006), children are seen as proactive agents with the capacity to self-influence their thought processes, cognition, and action through the demonstration of initiative (Kuczynski & Parkin, 2007). Behaviors based on intentionality, forethought, self-reactiveness, and self-reflectiveness are indicators of a child's agentic ability to exercise influence over oneself, thereby shaping one's own developmental trajectories (Bandura, 2006; Holden, 2010; Kuczynski & Parkin, 2007). It is especially important for young children preparing for school entry to have a wide range of experiences as proactive agents, actively engaging in one's own life, setting appropriate goals, and choosing and reflecting upon own behavior. The cultivation of this capacity may function as a lifelong core competency that promotes successful adaptation and development.

Initiative is a terminology that is broadly used in a theoretical sense, and its relatively ambiguous definition is utilized interchangeably in various studies. In addition, self-initiative research is fairly limited to the self-leading role in a learners' perspective, particularly targeting school-aged children and adolescents (Wehmeyer, Agran, & Hughes, 2000). Although researchers have progressed in identifying preschoolers' development of initiative, most studies have only been directed to explore the usefulness of child-related programs and activities (Oh, 2005). Behavioral aspects of

self-initiative are partly addressed in self-management strategies of self-leadership (Dolbier, Soderstrom, & Steinhardt, 2001; Lee, 2007; Ross, 2014) and behavioral self-regulation (Ponitz, McClelland, Matthews, & Morrison, 2009). Yet, few studies have been conducted that would adequately define and assess children's ordinary execution of self-initiative behavior in the context where they would ordinarily experience challenges. In other words, the need to elucidate self-initiative behavior encountered by preschool-aged children in the psychosocial context of classrooms is highly emphasized. By examining practical behavioral strategies of self-initiative, and by doing so in a socially stressful environment, implications for young children's exercise of agency may be ascertained.

One of the most consistent and robust predictors of child behavior in a social context is individual differences in temperamental characteristics (Band & Weisz, 1988; Carey, 1998; Frick & Morris, 2004; Martin, Nagle, & Paget, 1983; Mobley, & Pullis, 1991). According to Rothbart's psychobiological approach, temperamental traits are generally conceptualized as wide-ranging, steady characteristics of an individual's reactions to stimulus change and self-regulation, which are manifested early in life and are presumed to persist over time across the life course (Compas, Connor-Smith, & Jaser, 2004; Rothbart, Derryberry, & Posner, 1994). As such, temperament may exert direct effects on broad dimensions of development, such that particular characteristics directly increase the probability of developing certain types of behavior. Dispositions represented by extraversion, negative affectivity, and effortful control affect emotions frequently experienced by children (Rothbart, Ahadi, Hershey, & Fisher, 2001), how children perceive disagreeable, undesirable, or accidental incidences that might arise in social group

settings (Rothbart, Sheese, & Posner, 2007), and strategies that children choose to overcome those difficulties (Derryberry, Reed, & Pilkenton-Taylor, 2003; Lerner, & East, 1984). Thus, varying degrees of activity, emotional reactivity and attention regulation may be significant factors that determine a child's execution of self-initiative behavior.

Recently, researchers have given attention to the individual's inherent physiological response mechanisms in explaining human development. In fact, individual differences in stress response, indexed by the activity of the Hypothalamic-Pituitary-Adrenal (HPA) axis and its corresponding end-product hormone called cortisol, emerged to reflect constitutional variations in vulnerability and resilience to various types of stressors (Gunnar & Quevedo, 2007). According to recent theorists, physiological responsivity may function as a biological gateway that encodes and filters environmental information, regulating an organism's openness to contextual input (Del Giudice, Ellis, & Shirtcliff, 2011). Heightened physiological response to stress, therefore, manifests either negatively under adverse conditions or positively when potentiated by adequate environmental support and resources (Boyce & Ellis, 2005; Ellis and Boyce, 2008; Ellis, Essex, & Boyce, 2005), thereby favoring adaptation in both contexts. In other words, physiological stress responsivity are adaptively patterned in children, acting as an important biobehavioral mechanism for either filtering or amplifying information in social environment to organize a broad range of development, including one's behavior (Del Giudice et al., 2011).

Indeed, numerous studies have reported that differences in physiological responsivity are also largely based upon temperamental traits (Compas et al., 2004; Gunnar, Sebanc, Tout, Donzella & van

Dulmen, 2003; Mackrell, Sheikh, Kotelnikova, Kryski, Jordan, Singh & Hayden, 2014). For example, highly sociable, surgent children were found to exhibit elevated cortisol levels (Davis, Donzella, Krueger, & Gunnar, 1999; Gunnar, Tout, de Haan, Pierce, & Stanbury, 1997; Rothbart & Bates, 1998). Tendency toward discomfort, anger, sadness, fear, and low soothability have also led to heightened physiological arousal (Compas et al., 2004). Moreover, emerging literature suggests a strong association between hormonal responsivity and a broad range of physical, cognitive, socio-emotional, and behavioral outcomes (Allwood, Handwerger, Kivlighan, Granger & Stroud, 2011; Bauer, Quas & Boyce, 2002; Obradović, 2016). Patterns of physiological stress reactivity may, therefore, serve as strong implications in a wide range of adaptive functions structuring children's behavior. Accordingly, the degree to which children perceive environmental challenges as stressful is likely to be affected by their temperament, and is presumed to predict the subsequent conduct of self-initiative behavior.

Taken together, temperament serves as a key determinant of how organisms interact with their surrounding environment. Based on various temperaments, experiences are either amplified or filtered through differential physiological responsivity. Thus, individual differences in the physiological stress response, indexed by cortisol reactivity, may represent important ways in which children's temperamental characteristics are employed in self-initiative behavior under conditions of psychosocial challenges.

Despite a rich body of work linking temperamental influence on a diverse spectrum of behavioral development in early childhood, a unifying, empirical study that looks into the underlying mechanism of individual propensity in physiological stress response is rather

deficient. Moreover, although the influence of an individual's physiological response tendency on behavioral development has steadily been elucidated, extant studies tend to converge on the negative consequential aspects of physiological stress in child development. For example, preceding findings indicate that excessively high or low responses may lead to heightened risks of depression, anxiety and various kind of behavioral problems (Brooker, Davidson, & Goldsmith, 2016; Pérez-Edgar, Schmidt, Henderson, Schulkin & Fox, 2008). On the contrary, relatively fewer studies have focused on its constructive outlook (Schmidt et al., 1999; von Dawans, Fischbacher, Kirschbaum, Fehr, & Heinrichs, 2012).

Determining the mediating role of the physiological stress response can reveal how children begin to deal with, or regulate stress through their first line of involuntary and automatic coping responses in the face of social challenges. Furthermore, identifying the interplay among temperament and physiological responsivity can advance our understanding of how young children engage with challenges, cope with stressors, and achieve optimal arousal in order to exercise well-regulated behavior. In this regard, the current study aims to examine the effect of individual propensity in the physiological stress response for mediating the well-established association between temperament and self-initiative behavior functioning as a lifelong core competency. Findings of this study expect to provide clearer evidence of a more detailed, integrated relationship among temperament, physiology, and behavior.

II. Theoretical Background & Literature Review

This chapter delineates a review of theoretical framework and preceding literature relevant to the current study. The review is divided into four sections: (1) preschoolers' self-initiative behavior; (2) association between temperament and self-initiative behavior; (3) physiological stress response; (4) mediation effect of cortisol reactivity in association between temperament and self-initiative behavior. The main purpose of this review is to provide the rationale for identifying the mediating role of cortisol reactivity in preschoolers' temperamental effects on self-initiative behavior. Specific research questions will be drawn out by elucidating thoroughly the necessities of the current study.

1. Self-initiative Behavior

1) Defining the Concept and Developmental Value of Self-initiative

According to Erikson's stages of psychosocial development, a major developmental task in early childhood is the acquirement of initiative. Development of child initiative may be discussed from a perspective of child agency. In the social cognitive theory, Bandura adopts the concept of *human agency* towards development, adaptation, and change (Bandura, 1989; 2001; 2006). In this theory, human beings function as "proactive agents" to their life circumstances; thus, human beings are not just simple onlookers, but both contributors and products of their lives. To be an agent in one's life means to

intentionally influence the self, as well as the surrounding environment. In other words, individuals organize their own lives, actively engage in various life events, and regulate and reflect on these processes. In conjunction with a growing knowledge of the bidirectional nature of parent-child relationships that considers proactive roles of the child in shaping own development (Kuczynski & Parkin, 2007), agentic perspective has also been extended to mark young children.

Four core attributes of human agency proposed by Bandura provide important meanings to child's exercise of initiative as proactive agent. The core properties include intentionality, forethought, self-reactiveness, and self-reflectiveness. Children, as proactive agents, have the *intentionality* in their plans for behaviors and strategies. They practice deliberative *forethought* with more forward-looking goals and predictions of likely outcomes in advance. Children as agents not only plan or anticipate prospective events, but also deliberately choose appropriate behaviors and regulate their performances to *self-react.* In addition, children not only function as direct agents of their actions, but also *self-reflect* to directly review and evaluate their own functioning.

An enhanced perspective on child initiative has allowed the extension of research into self-initiative roles of young children. Representatively, Bandura has emphasized the importance of self-processes (Bandura, 1989; 2006). The *self* not only contributes to the demeanor of external influences, but also acts as an important proximal determinant of individuals' motivation and behavior (Bandura, 2001). In other words, self-determined actions influence the features of one's surrounding environment and makes meaningful changes to oneself. According to Bandura, the capacity to govern

one's own thinking processes, motivation and action is a uniquely human characteristic (Bandura, 2006).

Relatedly, the Internal Family Systems (IFS) model suggests a perspective that views the *self* as an internal system, composed of multiple subpersonalities, or parts (Dolbier et al., 2001). According to the IFS model, the Self is defined as an "active, compassionate inner leader containing the perspective, confidence and vision necessary to lead an individual's internal and external lives harmoniously and sensitively" (Schwartz, 1999). According to this model, the Self, as an internal leader, has the ability to utilize internal resources to improve its own internal environment, thereby promoting a more effective and adaptable interaction with the external environment. The central importance of the IFS is that the human internal system is distinguished from mechanical systems for its abilities to *self-correct* through an innate drive and wisdom for successful adaptation.

Taken together, children, as proactive agents, are not just unidirectional recipients playing passive roles in development, but have the capacity to shape their environments and self-influence their developmental trajectories (Holden, 2010) through the demonstration of self-initiative.

2) Importance of Cultivating Self-initiative Behavior at Preschool Age

The ability to exercise self-initiative as proactive agents in development is required from the age of preschool. The ecological transition from a family context to institutional environments marks dramatic changes in ways young children spend time, demands for self-control, compliance with authority, and the consequences for fulfilling these expectations (Duckworth & Allred, 2012). Challenges

that children may face in their social world include various interpersonal demands, such as relating successfully with peers, gaining peer acceptance, negotiating with new classrooms and acquiring new demands in a group context (Ladd, 1990). Additional duties of meeting new academic challenges with a complex array of interpersonal and cognitive tasks may be presented to children following school entry (Blair, 2002; Obradović, Bush, Stamperdahl, Adler, & Boyce, 2010). Since preschool is a critical period for developing diverse social interaction skills required for successful adaptation in school life, it is necessary to cultivate the capacity to independently deal with, or to overcome social stress and challenges during this stage. This may be accomplished by fostering self-initiative behavior through diverse experiences of independently setting goals, practicing and polishing required abilities, and self-regulating one's own behaviors.

Self-initiative behavior may function as the most flexible, adaptive behavioral strategy responding to social challenges, and it may consequently lead to better adaptation in later development. Acquiring experiences of making meaningful changes to the surrounding environment by carrying out personally planned and determined actions enhance young children's sense of personal efficacy (Zimmerman, 2000). Based on positive judgments of how well he/she can deal with prospective situations (Bandura,1982), a child's operative competency for the self can be improved, which may promote the future execution of self-initiative behavior. In later school life, children would be able to self-direct their own academic work more confidently and achieve better performances based on positive beliefs and expectations about the self (Dolbier et al., 2001).

Individuals with self-initiative behavior tend to actively confront problems and make greater effort to solve rather than to avoid or ignore these complications (Dolbier et al., 2001). Proactive behavior, therefore, serves as an adaptive, effective coping strategy when faced with various kind of taxing situations. Thus, the capacity to self-influence one's own behavior would ultimately ease the experience of stress.

Self-initiative behavior is also advantageous in promoting favorable personalities, such as optimism, hardiness, and a sense of personal control (Dolbier et al., 2001). Individuals' self-determined behaviors allow for acquiring a trust of the self, increasing confidence to maintain harmony with the external environment. In this instance, individuals tend to perceive stress as an opportunity that leads to a more effortful, enthusiastic commitment to such circumstances. By gaining the sense of personal control, individuals are better able to bounce back and readily recover from experiences of stress.

2. Temperament and Self-initiative Behavior

Temperament is generally defined as constitutional differences in individuals' emotional and behavioral characteristics that are manifested relatively early in life and persist over time across the life course (Compas et al., 2004; Rothbart, Ahadi, & Hershey, 1994). The pioneering work of Thomas & Chess (1986)'s New York Longitudinal Study (NYLS) inspired the efforts to categorize individual's temperamental characteristics and their functional significance. Importantly, Rothbart and his colleagues (1994) conceptualized temperament as a wide-ranging, steady characteristic of an individual's reactivity to stimulus change and self-regulation, based on the premise that temperamental traits constitute a biological basis (Rothbart et al., 1994; 2001). According to Rothbart's psychobiological perspective, reactivity refers to the threshold of sensitivity, potential and intensity of response, and functional states of the arousal mechanism that occur in the time of onset and recovery. Self-regulation, on the other hand, refers to cognitive, emotional, and behavioral processes functioning to modulate the reactive state of the organisms (Rothbart & Derryberry, 1981). In subsequent studies, Rothbart and colleagues have progressed to classify temperament based on individual differences in motor, emotional, and attentional reactivity, proposing three generic dimensions: extraversion, negative affectivity, and effortful control (Rothbart et al., 1994; 2007).

As the dimensions of temperament became more concretely defined, researches investigating the associations between temperament and both immediate and later adaptation have also been advanced (Rothbart & Bates, 1998); contributions of temperamental styles to socio-emotional development of preschoolers', in particular,

has long been a primary interest for scholars. Especially by the time of school entrance, temperament affects the features of the child's adaptation to the requirements and challenges of the new academic environment. Thus, variability in the sensitivity of activity levels, emotional reactivity, and attention regulation may exert direct influence over children's execution of self-initiative behavior (Band & Weisz, 1988; Derryberry et al., 2003).

Extraversion includes characteristics related to high activity, low shyness, smiling/laughter, high intensity pleasure, positive anticipation, and approach preference. Individuals scoring high in extraversion are generally conceptualized as displaying a strong approach preference toward novel and difficult environmental factors (Rothbart et al., 1994; 2001). They are inclined to be outgoing, sociable, sensation seeking, easily get along with new adults and peers; thus, these individuals are most actively involved with their surrounding environment (Rothbart & Bates, 1998). These characteristics may be of central importance to children's social experiences in an institutional context; their association with enthusiasm, intense desire to know, and energy toward goal attainment may pose either advantageous or disadvantageous requisites for conducting self-initiative behavior in the classroom. Based on positive beliefs about the self (Rothbart & Bates, 1998), extroverted children may actively manage or supervise their own behaviors as proactive agents. Indeed, previous findings have pointed to the role of approach and flexibility factors, among other attributes constituting extraversion, in supporting a child's capacity to effectively and adaptively regulate one's own emotions (Yagmurlu & Altan, 2010). The ability to regulate one's emotions in a healthy, appropriate way is a critical competency required for children's self-initiative behavior in their social world, where they

confront situations with unexpected and possibly undesirable obstacles.

However, disproportionate propensity to extroversion may impede children's development of self-initiative behavior. Individuals exhibiting immoderate levels of activity have a higher tendency for using negative, inappropriate strategies for self-regulation, which are characterized as emotion-explosive, aggressive, and avoidant behaviors (Lengua & Long, 2002). In addition, children with excessively high levels of distractibility, along with a low capacity for task-concentration are at a higher risk for developing externalizing problem behaviors (Karp, Serbin, Stack, & Schwartzman, 2004; Rothbart & Putnam 2002). Considering that excessively extroverted children are more prone to impatient and impulsive behavior, there is a potential that a negative behavioral pattern, such as self-centeredness, may be highlighted rather than the capacity to self-initiate.

Negative affectivity is traditionally categorized as "difficult" temperament (Thomas & Chess, 1977), and is generally conceptualized as a temperamental precursor for later display of emotional and behavioral problems (Henderson, Fox, & Rubin, 2001). These traits encompass high positive loadings of irritability/frustration, fearfulness, tendencies to discomfort, sadness, anger and low soothability. Children scoring high on negative affectivity have a general propensity to experience negative emotions more frequently and intensely against stressful situations (Rothbart et al., 2001). Since these individuals are more likely to perceive disagreeable, undesirable or accidental incidences that may arise in social contexts as pessimistic (Lengua & Long, 2002; Lengua, Sandler, West, Wolchik, & Curran 1999), there is a considerable potential that these inclinations could hinder children's

demonstration of self-initiative behavior in the classroom environment. This is also supported by previous findings highlighting the role of temperamental negative affectivity for predicting later maladaptation. Preceding research has revealed that inhibitory dimensions of negative affectivity, such as sadness and fear, are highly predictive of the development of socially withdrawn behavior, whereas dimensions characterized as overt and reactive, such as anger and frustration, predict the emergence of externalizing (Gilliom & Shaw, 2004; Karreman, de Haas, Tuijl, van Aken, Dekovic, 2010), as well as some internalizing problems (Eisenberg et al., 2001; Seifer, 2000; Oldehinkel, Hartman, DeWinter, Veenstra & Ormel, 2004). Moreover, children who exhibit the tendency to become easily irascible with novel, challenging, and presumably unpleasant events are considered to have a particular sensitivity to the Behavioral Inhibition System (BIS; Gray, 1991), accountable for processing information related to threat and punishment. Activation of the BIS may lead to heightened emotional arousal, increased vigilance, and most importantly, restricted behavior. Thus, children who are profoundly inhibited with feelings of unhappiness may be less able to flexibly plan and perform self-initiated strategies and actively interact with the surrounding environment to take part in leading themselves.

Effortful control is generally known to be a fundamental attribute in social interactions and is typically discussed as a major form of self-regulation (Rothbart & Bates, 1998). It includes facets of attentional focusing, inhibitory control, high perceptual sensitivity, high persistence, and planfulness (Compas et al., 2004; Putnam & Rothbart, 2006; Rothbart et al., 2001; 2007). Unlike the reactive dimensions of temperament, such as extraversion and negative affectivity, effortful control is important in that it is regulatory,

intentional and voluntary (Duckworth & Allred, 2012). In this respect, the possibility of a positive association between effortful control and self-initiative behavior may be suggested.

Children's ability to self-initiate against new demands and expectations posed in a classroom context may arise with the capacity to control attention, inhibit impulses, and initiate appropriate actions by suppressing dominant responses (Eisenberg et al., 2004). Relatedly, temperamental traits of effortful control predict a range of positive developmental outcomes in virtue of its allowance for flexible and deliberate inhibition over reactive tendencies (Eisenberg et al., 2004). Previous findings indicate that a child's attentional regulation predicted the use of active coping strategies in stressful, challenging situations, such as direct problem solving, cognitive decision making, and positive cognitive restructuring (Lengua & Long, 2002), as well as the effective use of various strategies to monitor and modulate one's emotional state (Yagmurlu & Altan, 2010). Based on the flexible control of attention and perceptual competency, children can effectively regulate negative emotions in a social context, and ultimately control the execution of their social behaviors in appropriate ways.

Considering that temperamental differences may cause children to process the same environment differently (Rothbart & Bates, 1998), it is crucial to determine the effects of temperament on preschoolers' execution of self-initiative behavior. Although evidence that infers the potentiality of temperamental effects on the development of self-initiative behavior abounds, existent literature lacks in research that directly measure the association between temperament and self-initiative behavior.

3. Physiological Stress Response

1) Physiological Stress Response System

Stress is often considered a matter of psychological construct, but it may also be discussed from a neurobiological point of view (Dantzer, 1991; Gunnar & Quevedo, 2007). When we encounter events that are potentially stressful or challenging, a combination of neural, neuroendocrine and neuroendocrine-immune mechanisms is activated in concert to retain viability through adjustment (McEwen, 1998). In fact, our bodies are constantly working to achieve "stability through change", or *allostasis* (Sterling & Eyer, 1988), through the activation of the stress response system.

The stress response system comprises two anatomically diverse but closely integrated circuits; the autonomic nervous system (ANS), with the branches of sympathetic and parasympathetic circuits, and the hypothalamic-pituitary-adrenocortical (HPA) system (Chrousos, 2009). As a part of the "fight-or-flight" reaction, the ANS offers the first layer of response in the face of stressful and challenging situations by facilitating a rapid mobilization of metabolic resources (Gunnar & Quevedo, 2007). The HPA system, on the other hand, provides the second layer of response to stressors that are presumed to be overwhelming and unpredictable by the release of glucocorticoid hormones called *cortisol* (Koolhaas et al., 2011; Rash et al., 2016). Cortisol takes an active part in dealing with the stressors by mobilizing appropriate physiological and psychological resources (Sapolsky, Romero, & Munck, 2000), and represses further release of corticotrophin-releasing hormones in order to down-regulate the HPA axis through the negative feedback mechanism (Flinn, 2006).

With the capacity to cross the blood-brain barrier, a major target

of cortisol is the regions of the brain, especially the areas in charge of memory and learning (Sapolsky, 1996; 1999). In particular, dysfunction in the hippocampus, which is responsible for episodic and declarative memory, may contribute to distorted perceptions of circumstances as more stressful, to a greater degree than the absence of the dysfunction (Gunnar & Quevedo, 2007). Major impacts of cortisol occur primarily through a modification of gene expression (de Kloet, Oitzl, & Joëls, 1999), resulting in delayed and prolonged influences on physiology and behavior (de Kloet et al., 1999; Sapolsky et al., 2000). These effects may be detrimental when it occurs during periods of rapid brain development; its consequences may include serious alteration of pathways and organization of the brain activity (Gunnar & Quevedo, 2007), such as inhibition of neurogenesis, disruption in neuronal plasticity, increased neurotoxicity, loss of synaptic connectivity and increased cellular death (Lundberg, Westermark, Rasch, 1993; Price, Close, & Fielding, 1983; Sapolsky, 1996). Thus, sensitive periods of early childhood, with an enhanced capacity of brain plasticity, represent a time of particular vulnerability to stress, and environmental stressors that occur during this period may have a more pronounced effect on the solidification of the physiological stress responsivity (Gunnar & Quevedo, 2007; Lupien, McEwen, Gunnar, & Heim, 2009).

Consequently, comprehending the antecedental factors that give rise to individual variations in stress responsivity, as well as subsequent effects and processes leading to it, has become a major focus in studies of neuroscience, psychology, and child development (Kiel & Kalomiris, 2016; Mackrell et al., 2014; Rash et al., 2016).

2) Theoretical Perspectives on Physiological Stress Response System

Theories on the physiological stress response have initially been formulated through attempts to conceptualize the nature of the diathesis-stress interactions as antecedents of psychopathological diseases, such as schizophrenia and depression (Hilsman & Garber, 1995; Monroe & Simons, 1991; Robins & Block, 1989). The term, *diathesis*, which is synonymous with vulnerability, is derived from the Greek word for disposition (McEwen, 1998). It is conceptualized as being endogenous, relatively enduring, and latent in state that includes biological, genetic, physiological, cognitive, and personality-related factors (Ingram & Luxton, 2005). According to the diathesis-stress model, stress refers to a life event or series of events that disorganize an individual's psychological equilibrium and potentially functions as a catalyst for developing various kinds of disorders (McEwen, 1998). The basic assertion of this model is that environmental *stressors* provoke biological or genetic traits of *diathesis* to unfold, and when a combination of stressors exceeds a certain threshold, the preexisting vulnerability transforms into psychopathology (Monroe & Simons, 1991). Thus, exaggerated stress reactivity, according to diathesis theorists, is reflective of a maladaptive, consistently detrimental response predisposition that situates individuals at a heightened risk for developing disorders in the face of stressful, challenging environments (Cummings, El-Sheikh, Kouros, & Keller, 2007; El-Sheikh, 2005; Ramos, Guerin, Gottfried, Bathurst, & Oliver, 2005,).

Although a substantial amount of literature had supported the stress-diathesis model, some researchers have raised objections to this traditional perspective. The central assertion is that heightened stress reactivity is not reflective of a disease response to adversity

that uniformly advances to maladaptation in all persons (Belsky, 2005; Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2007; Belsky, Hsieh, & Crnic, 1998). For instance, Jay Belsky's *differential susceptibility hypothesis* postulates that children, as a result of temperamental and genetic variations, differ in their susceptibility to the contextual input in a "for better and for worse" manner (Belsky, 2005; Belsky, et al., 2007). Instead of a general conceptualization of children's response propensity as more or less prone to their nurturing environment, Belsky and colleagues (2007) have postulated that it may be more adequate to consider children as differing in their susceptibility with regard to specific developmental outcomes (Blair, 2002; Klein Velderman, Bakermans-Kranenburg, Juffer, & van IJzendoorn, 2006).

Boyce & Ellis (2005) have postulated a novel hypothesis concerning stress reactivity and health: eminently high reactive phenotype does not simply reflect a predisposition to vulnerability, but can better be described as demonstrating a heightened *biological sensitivity to context* (BSC). In other words, individual differences in stress reactivity may provide selective advantages depending on the ecological contexts individuals are exposed to (Ellis & Boyce, 2011). According to this theoretical perspective, children with increased biological sensitivity are not only anticipated to be more vulnerable to negative environmental factors, but also exhibit a greater capacity to flourish from positive contextual influences (Boyce & Ellis, 2005; Ellis & Boyce, 2011). Thus, heightened biological reactivity, which previously was thought maladaptive, represents a neurobiologically enhanced sensitivity to environmental influences that may instead function as an adaptive mechanism in a highly supportive and protective environment (Ellis et al., 2005).

Most recently, in extending and refining the theory of *biological sensitivity to context* (BSC; Boyce and Ellis, 2005; Ellis & Boyce, 2008; Ellis et al., 2005), an evolutionary-developmental theory of individual differences in stress responsivity, known as the Adaptive Calibration Model (ACM) was developed (Del Giudice et al., 2011). The ACM posits that individual variations in stress responsivity are largely shaped through the process of conditional adaptation; that is, organisms evolutionarily acquire physiological responsivity to shape their own developmental trajectories in a way that enables them to function competently in a variety of contexts (Del Giudice et al., 2011). According to this newly developed perspective, phenotypic propensity of an individual's stress responsivity may be adaptively patterned. In regards to this postulation, the physiological stress response system exhibits three biological functions: (1) to regulate one's reaction towards mechanical or psychosocial challenges; (2) to filter or amplify environmental input by mediating the organism's openness to contextual influences; and (3) to coordinate one's physiology and behavior conforming to his/her life history.

An important point to this conceptualization is that the physiological stress response system may function as an underlying biobehavioral mechanism for either filtering or amplifying information regarding a child's surrounding environment. Moreover, the ways in which children spend time and energy to diverse incidences in life function to establish alternative patterns of stress responsivity, which may consequently yield related variations in behavior (Del Giudice et al., 2011; Del Giudice, Hinnant, Ellis, & El-Sheikh, 2012).

3) Psychosocial Stressors and Cortisol Reactivity

Cortisol, the end-product of the HPA axis activation, can be conveniently measured by sampling saliva and reliably triggered in response to a laboratory-based psychological stressor (Dickerson & Kemeny, 2004). Over the past half century, an extensive amount of literature in physiological stress response has focused on the effects of laboratory psychological stressors. Consequently, researchers have drawn two broad conclusions. First, psychologically-induced stressors such as physical factors (e.g., prolonged exercise) are indeed capable of triggering the HPA axis (Gunnar, Talge, & Herrera, 2009). Second, although the HPA axis is generally known to be activated in the face of wide-ranging negative situations, corresponding physiological responses are immensely variable (Dickerson & Kemeny, 2004). This suggests that identical stressors may not uniformly provoke monotonous neurobiological feedback; there may exist certain kinds of stressors, specifically those with particular characteristics, were associated with elevations in cortisol response (Dickerson & Kemeny, 2004). Relatedly, some researchers have progressed into the more detailed, particularized set of eliciting conditions. In fact, empirical data suggests that the intensity of HPA response varies with the degree of requiring comprehensive, substantial operation of metabolic and psychological resources in challenges (Del Giudice et al., 2011).

In an attempt to formulate a more standardized guideline for designing laboratory research with acute psychological stressors, Dickerson & Kemeny (2004) have performed meta-analytic reviews on 208 laboratory studies and established the validity of a theoretical model outlining essential conditions that most reliably evoke cortisol responses. According to this review, a combination of three specific

circumstances dependably provoke considerable cortisol elevation: (a) situation involving a social-evaluative threat with the possibility of receiving negative judgment in regards to self-identity; (b) uncontrollability that could hinder progress toward accomplishing goals; (c) motivated performance task with personally desired aims.

An essential feature of basic human desires is the need to protect the social self, and threats to endanger social esteem, social-status and self-worth could lead to an increased wariness (Silk, Davis, McMakin, Dahl, & Forbes, 2012). Evidence indicates that children as young as age 4 also exhibit desires for interpersonal belonging (Osterman, 2000), and vigilance to social status and rejection (Dodge et al., 2003). Threats to social evaluation is most likely to happen when lack of success or unsatisfactory performance could disclose one's inadequacy in core attributes that are widely valued, such as intelligence or competence (Crocker, 2002; Kirkpatrick & Ellis, 2001; Leary & Baumeister, 2000). Moreover, stress encountered in the face of social threats could further be amplified when circumstances are beyond one's control. In situations characterized as uncontrollable, children could hardly change the subsequent outcomes despite their behavioral efforts (Dickerson & Kemeny, 2004). The context of inevitable failure could significantly amplify threats in social evaluation and consequently lead to augmented cortisol response (Dickerson & Kemeny, 2004). Importantly, this uncontrollability must arise in the context where an important motivational domain is being threatened in order to successfully trigger the stress response system. Situations lacking a motivational purpose (e.g., passive induction of noise exposure) failed to increase cortisol levels.

For preschool-age children, the classroom is a socially challenging environment where incidents of various attempts, conflicts,

cooperation, compromises and compliances take place. In such an environment, children may be assigned with specific tasks through a variety of activities, be evaluated by peers and teachers, or face unexpected events. A child's stress response in these settings can vary from person to person, which, in turn, may affect adaptive, effective coping responses. However, most of the extant research is limited in that characteristics of the social environment are not adequately reflected in the research design. Taken together, a laboratory task involving social-evaluative threats, in which one's valuable goal is intimidated and the preferable consequence is not reliant on one's behavior, is required to foster a similar social stress environment that preschoolers may experience in classrooms. By provoking children's stress response in an experimental setting where these conditions are well met, individual differences in stress response to social challenges could more clearly be revealed.

4. Relationship Between Temperament, Cortisol Reactivity, and Self-initiative Behavior among Preschoolers

Temperamental dispositions in activity levels, emotional reactivity, and attention regulation determine the frequent emotions experienced by children (Rothbart et al., 2001), approach preference toward novelty (Derryberry et al., 2003), ways children perceive disagreeable, undesirable, accidental incidences that might arise in social group settings (Rothbart et al., 2007), and the type of strategies children use to overcome those difficulties (Derryberry et al., 2003; Lerner & East, 1984). In other words, ways in which children interact with their surrounding environment are greatly shaped through genetic underpinnings of individual differences in temperament. Importantly, the functional significance of temperament is most distinctly unfolded as a form of differential response to stress (Strelau, 2001).

According to Compas and his colleagues (2001), responses to stress are enacted through two distinct processes: controlled and automatic (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001). Controlled responses are related to an organism's volitional, conscious efforts toward the regulation of cognitive, emotional, and behavioral responses to stressful situations, whereas automatic responses are not under one's conscious control, but instead achieved through reactions of physiological arousal, emotional vigilant, involuntary flight behavior and automatic shifts in attention (Compas et al., 2001). When these notions are applied to the social challenges experienced by preschoolers, children not only respond to environmental disequilibrium through their voluntary, intentional efforts to execute proactive behavior, but also counteract with unconsciously controlled stress response implemented at the

physiological level.

According to the Adaptive Calibration Model (ACM), the automatic stress response of an organism is achieved by adjusting environmental input in such a way to enlarge or buffer it (Del Giudice et al., 2011; 2012). As noted earlier, individual differences in temperament contribute both to an organism's introductory automatic stress response and to restrain or promote certain types of volitional coping response (Compas, 1987; Ficková, 2001; Lengua et al., 1999). For example, temperamentally inhibited children tend to exhibit a lower threshold for stress response activation, recover or return to ground state more slowly, and/or become more greatly aroused with repeated exposures to stress (Compas et al., 2001). Indeed, inhibited children are often found to display exaggerated cortisol reactivity to socially provocative events (Kagan, Reznick, & Snidman, 1987; Schwartz, Wright, Shin, Kagan, & Rauch, 2003). Children who are high in shyness, anxiety, and fearfulness also demonstrate higher cortisol increase in the face of novel challenges (Rosen & Schulkin, 1998). A link between effortful control and cortisol response is rather mixed in that some studies show significant positive association (Spinrad et al., 2009), while others present negative associations (Donzella, Gunnar, Krueger, & Alwin, 2000; Gunnar et al., 1997; 2003). Likewise, highly surgent or exuberant children displayed elevated levels of cortisol at certain times (Fox, Henderson, Rubin, Calkins, & Schmidt, 2001), and diminished levels of cortisol at other times (Gunnar et al., 2003).

In fact, the ACM has highlighted the functional significance of biobehavioral mechanisms of stress response in shaping patterns of both concurrent and prospective adaptation in childhood; importantly, individuals are expected to adopt certain patterns of life

history-related behaviors (Del Giudice et al., 2011). Children who are classified as exhibiting highly sensitive phenotype are generally more reflective, strongly conscious of the self and others, and are more likely to engage with their surrounding environment (Del Guidice, 2011). These children also display high levels of executive function, inhibitory control and delay of gratification, which imply better self-regulation capabilities. Children with relatively moderate responsiveness, on the other hand, are presumed to be less sensitive to social feedback, relatively less susceptible to adversity, and are low in aggression and anxiety (Del Guidice, 2011). Considering these findings, it may be suggested that individual propensity in physiological stress response could also be a significant predictor of preschoolers' execution of self-initiative behavior.

Based on the preceding evidence, it can be deduced that there exists a structural relationship among temperament, physiology and behavior. Postulation made by the ACM (Del Giudice et al., 2011) also implies an intermediary relation for these variables; specifically, the genetic underpinnings of temperamental vulnerability can be regulated through differential stress responsivity implemented at the physiological level, which may ultimately determine the execution of self-initiative behaviors in a socially challenging environment.

The extant research has often overlooked how children deal with stress through their first line of involuntary and automatic coping responses, and has failed to capture the integrated relationship among the two distinct processes of stress response. Despite a rich body of work linking temperamental influence on the diverse spectrum of behavioral development in early childhood, a unifying, empirical study that ascertain the effects of individual propensity in physiological responsiveness on temperamental consequences of behavior is lacking.

In this regard, the current study aims to investigate the role of physiological responsivity, represented as cortisol reactivity, in association between temperament and self-initiative behavior. Verification of the ACM and roles of stress response may provide deeper insights into the underlying functioning of physiological mechanisms in child development.

III. Research Questions & Definition of Key Terms

Based on the foregoing theoretical background and literature reviews, the following research questions were established and the related terms were operationally defined.

1. Research Questions

Considering the problems and necessities discussed above, the current study aims to investigate the role of cortisol reactivity as a potential mediator linking the association between preschoolers' temperamental characteristics and self-initiative behavior shown in the classroom environment. As a result, the following three research questions emerge. The first question aims to explore the correlation between preschoolers' temperament, cortisol reactivity and self-initiative behavior. The second question examines the causal relationship between the principal variables. The last question inquires into the role of cortisol reactivity in mediating the relationship between temperament and self-initiative behavior.

1. Is there a correlation among temperament (extraversion, negative affectivity, effortful control), cortisol reactivity, and self-initiative behavior (goal-setting, self-practice, self-control) among 5-year-old preschoolers?

2. Does temperament (extraversion, negative affectivity, effortful control) affect cortisol reactivity and self-initiative

behavior of 5-year-old preschoolers?

1) Does temperament (extraversion, negative affectivity, effortful control) affect cortisol reactivity of 5-year-old preschoolers?

2) Does temperament (extraversion, negative affectivity, effortful control) affect self-initiative behavior of 5-year-old preschoolers?

3. Does cortisol reactivity have mediating effects on the association between temperament (extraversion, negative affectivity, effortful control) and self-initiative behavior among 5-year-old preschoolers?

2. Definition of Key Terms

The following operational definitions clarify the key terms used in this study.

1) Self-initiative Behavior

Self-initiative behavior corresponds to behavioral strategies among three distinct, yet complementary categories of self-leadership (Manz, 1992; Neck & Manz, 1992). In the present study, a child's self-initiative behavior is operationally defined as the teachers' appraisal of a child's independent goal setting, practical efforts towards goal pursuit, and ability to self-regulate one's own actions observed in the classroom environment where various incidents of social challenges occur. Based on Manz & Neck (2004)'s classification,

three factors that constitute self-initiative behavior are examined in this study: goal-setting, self-practice, and self-control.

Goal-setting refers to self-determination of goals and priorities of task outcomes. Self-practice refers to an attitude of practicing body-mind prior to performing a task. Self-control refers to an intentional suppression of prohibited, inappropriate behaviors and includes the ability to resist temptation, delay satisfaction, and suppress impulses.

2) Temperament

Temperament refers to a wide-ranging, steady, psychobiological characteristic of oneself demonstrating individual differences in responses to stimulus change and self-regulation (Rothbart & Bates, 1998). Based on the classification standards of Rothbart and colleagues (2001), the present study categorizes a child's temperament into three broad dimensions: extraversion, negative affectivity, and effortful control.

Extraversion refers to a child's approach preference, high activity, high intensity pleasure, and positive anticipation to external stimuli. Negative affectivity refers to a child's typical vulnerability towards negative emotions such as anxiety, fear, anger, frustration, and sadness. Effortful control refers to the ability of a child to intentionally focus on stimulation and to flexibly regulate attention.

3) Cortisol Reactivity

Cortisol reactivity refers to a physiological stress responsiveness, indicative of the individual variations in susceptibility against

contextual opportunities and threats (Boyce & Ellis, 2005; Ellis, Boyce, Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2011; Gunnar & Quevedo, 2007; Loman & Gunnar, 2010). Cortisol is a hormonal end-product of the major neuroendocrine circuit called the HPA axis organizing the human physiological stress response system.

In the present study, cortisol reactivity is defined as the magnitude of change in the concentration of preschoolers' salivary cortisol in response to a psychosocial challenge, which includes constructs of social evaluation, uncontrollability, and motivational performance task. Since cortisol responsiveness reflects biological sensitivity to context (Boyce & Ellis, 2005), higher cortisol reactivity in the current study represents preschoolers' heightened sensitivity to psychosocial challenges.

IV. Methods

This chapter aims to provide a detailed description of study methods and procedures for verifying the previously presented research questions. A comprehensive depiction of the process for selecting suitable research subjects, constructing appropriate research tools, and a series of conducted research procedures are illustrated in this section. The method for data analysis suitable for the collected data is also provided in detail.

1. Participants

Participants of this study were 5-year-old preschoolers (N = 135) and their teachers (N = 13), recruited from childcare centers and kindergartens located in Seoul, Daegu, and Kyungi province of the Republic of Korea. Preschoolers were selected upon the following eligibility: born in January to December of 2010, attend a child-related institution, had not suffered from any major diseases, and were not classified as having special needs (e.g., developmental disabilities, chronic illnesses or behavior disorders). Out of the 135 preschoolers whose parents agreed upon their participation, 5 children who failed to fulfill the minimum quantity of saliva for analysis (0.05mL), 2 outliers who had displayed a large deviation of cortisol concentration from the normative range (0.012~3ug/dL), 2 children who were only present for a portion of the experiment, and 1 child who had to withdraw due to an emotional problem were excluded from the final analysis. Thus, the results from a total of 125 preschoolers were analyzed.

The present study specifically selected 5-year-old preschoolers as

the research target for the following reason. Investigation of self-initiative behavior during salient developmental transitions to school settings is very important, given that this capacity affects children's later school adjustment and academic performance (Kim, 2014). Since preschool is a critical stage for cultivating the capacity to independently deal with or to overcome social stress and challenges, the necessity to examine behavioral characteristics of children at this age was apparent.

Descriptive statistics for the participants' demographic background are presented in Table 1. The mean age of children was 75.03 months (75.15 months for boys, 74.94 months for girls). As for the birth order of participants, 15 children were the only child, 33 were first-borns, 54 children were the second child, 18 children were the third child or later. Most of the participating children had spent time in child institutions for over three years (107 children, 85.6%). Looking at parental variables, a majority of mothers were junior college and university graduates. Specifically, 46 (36.8%) mothers were junior college graduates, and 41 (32.8%) were university graduates. For fathers, 28 (22.4%) were high school graduates, 36 (28.8%) were junior college graduates, and 42 (33.6%) were university graduates. The family income variable was relatively evenly distributed among participants: 30 (24.05%) earned 3.1 million ~ 4 million won per month, and 28 (22.4%) earned 4.1 million ~ 5 million won per month, indicating that the majority of subjects in this study are from lower to middle class income families.

Table 1

Demographic Background of the Participants

		Sex		Total
		Boys	Girls	
Age (months)		75.15	74.94	75.03
Birth order	Only child	9 (16.1)	6 (8.7)	15 (12.0)
	First	21 (37.5)	12 (17.4)	33 (26.4)
	Second	20 (35.7)	34 (49.3)	54 (43.2)
	Third or below	5 (8.9)	13 (18.8)	18 (14.4)
	Others	-	3 (4.3)	3 (2.4)
	No response	1 (1.8)	1 (1.8)	2 (1.6)
Period of time spent in child institution	6 months - 1 year	1 (1.8)	-	1(.8)
	1 - 2 years	-	-	-
	2 - 3 years	9 (16.1)	6 (8.7)	15 (12.0)
	3 years or more	45 (80.4)	62 (89.9)	107 (85.6)
	No response	1 (1.8)	1 (1.4)	2 (1.6)
Mother's education	High school graduate	11 (19.6)	14 (20.3)	25 (20.0)
	Junior college graduate	25 (44.6)	21 (30.4)	46 (36.8)
	University graduate	17 (30.4)	24 (34.8)	41 (32.8)
	Enrolled in/graduated from graduate school	1 (1.8)	7 (10.1)	8 (6.4)
	Other	1 (1.8)	2 (2.9)	3 (2.4)
	No response	1 (1.8)	1 (1.4)	2 (1.6)
Father's education	High school graduate	14 (25.0)	14 (20.3)	28 (22.4)
	Junior college graduate	15 (26.8)	21 (30.4)	36 (28.8)
	University graduate	20 (35.7)	22 (31.9)	42 (33.6)
	Enrolled in/graduated from graduate school	5 (8.9)	11 (15.)	16 (12.8)
	Other	-	-	-
	No response	2 (3.6)	1 (1.4)	3 (2.4)
Family income per month (won)	Below 2 million	2 (3.6)	1 (1.4)	3 (2.4)
	2 million ~ 3 million	9 (16.1)	7 (10.1)	16 (12.8)
	3.1 million ~ 4 million	12 (21.4)	18 (26.1)	30 (24.0)
	4.1 million ~ 5 million	15 (26.8)	13 (18.8)	28 (22.4)
	5.1 million ~ 6 million	8 (14.3)	11 (15.9)	19 (15.2)
	Above 6 million	9 (16.1)	17 (24.6)	26 (20.8)
	No response	1 (1.8)	2 (2.9)	3 (2.4)
Total				125

Note. N = 125.
Numbers in brackets represent percentages.

2. Measures

1) Self-initiative Behavior

To obtain measures of self-initiative behavior, *Children's Self Leadership Scale* developed by Lee (2007) based on the Manz & Neck (2004)'s classification was used. In this particular study, the sub-scale of *self-management,* which encompasses behavioral strategies of self-leadership and is constructed upon the social cognitive theory, was selected.

The dimension of *self-management* is composed of three subfactors (goal-setting, self-practice, and self-control) and operationally re-defined as *self-initiative behavior* in the current study. A total of 33 items are in the scale, including children's independent goal-setting (e.g., "*This child makes plans before he/she plays a game.*") which is composed of 12 items, self-practice (e.g., "*This child tries many times to build a tall stack of toy blocks.*") which is composed of 12 items, and self-control (e.g., "*This child restrains him/herself and makes demands calmly even when he/she is angry.*") which is composed of 9 items. Teachers reported on each child's self-initiative behavior based on their reflections. The response scale is constructed in the form of a 5-point Likert, and items constructed as negative were reverse-coded. A low score for each subset indicates that a particular behavior was rarely observed.

The internal consistency reliability of goal-setting, self-practice, and self-control is 0.90, 0.86 and 0.79 respectively. The Cronbach's alpha for average self-initiative behavior was 0.94. More details are given in Table 2, and the full list of questionnaires are presented in Appendix 1.

Table 2
Constructs, Item Numbers and Cronbach's alpha of Self-initiative Behavior Scale

Dimensions	Constructs [Item numbers]	Number of items	Cronbach's alpha
Goal -setting	Refers to a child's behavioral tendency toward independent goal-setting, planning, and making priorities for tasks and outcomes. [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]	12	0.90
Self -practice	Refers to a child's behavioral tendency toward deliberate thinking and practicing before performing any task. [13*,14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24]	12	0.86
Self -control	Refers to a child's behavioral tendency toward effective inhibition of inappropriate behavior by acting in accordance with his/her intentions and plans. [25, 26*, 27, 28, 29, 30, 31*, 32*, 33*]	9	0.79

Note. *Items reverse-coded.

2) Temperament

Children's Behavior Questionnaire-very short form (CBQ) derived from the long version (Rothbart et al., 1994; 2001) was used to assess children's temperament. On the ground of Kim (2013)'s translation in Korean, the scale has further been modified and developed into the teacher's version in the current study.

The very short version of the CBQ is divided into three broad dimensions, with a total of 36 items: extraversion (e.g., "*This child tends to rush impatiently when he/she moves from one place to another.*"), negative affectivity (e.g., "*This child becomes very*

frustrated when he/she is stopped from doing what he/she wants to do."), and effortful control (e.g., "*This child is often engrossed in picture books, reading them for a long time.*"). The response scale of each item was in the form of a 5-point Likert scale. Teachers reported on each child's temperament based on their reflections. Items constructed as negative were reverse-coded. High scoring in one dimension indicates that the relevant temperament seems conspicuous. Each dimension of temperament was computed as average standardized scores, and the Cronbach's alpha for extraversion, negative affectivity, and effortful control were 0.71, 0.79, and 0.76 respectively. More details are given in Table 3, and the full list of questionnaires are presented in Appendix 1.

Table 3
Constructs, Item Numbers and Cronbach's alpha of CBQ Very Short Version Scale

Dimensions	Constructs [Item numbers]	Number of items	Cronbach's alpha
Extraversion	Characterized by high positive loadings of approach preference, impulsivity, high intensity pleasure, and positive anticipation. [1, 5, 7, 10, 11*, 14, 17*, 19*, 20, 22, 25*, 29*]	12	0.71
Negative affectivity	Characterized by high positive loadings of irritability, frustration, fearfulness, discomfort, sadness, anger, and low soothability. [2, 4, 13, 16, 18, 23, 27*]	7	0.79
Effortful control	Characterized by high positive loadings of attentional focusing, inhibitory control, perceptual sensitivity, persistence, and planfulness. [3, 6, 8, 9, 12, 15, 21, 24, 26, 28, 30, 31]	12	0.76

Note. *Items reverse-coded

3) Cortisol Reactivity

For the measurement of cortisol reactivity, Salivary Hormone Analysis (SHA) was carried out. Preschoolers' specimens of saliva were collected before (i.e., baseline) and after (i.e., reaction) their engagement in a psychosocial stress task, and the magnitude of change in salivary cortisol concentration was computed as a final variable.

(1) Psychosocial stress paradigm

The *Trier Social Stress Test for Children (TSST-C)* constructed by Buske-Kirschbaum et al. (1997) was administered to create a laboratory condition involving psychosocial stress. The child version of TSST consists of a task combination of public speaking and a mental arithmetic test involving serial subtraction. The mathematical task is intentionally designed as difficult, which inevitably leads to errors.

In consideration of participants' age and race, TSST-C used in the current study was slightly modified to make it more suitable for 5-year-old Korean preschoolers. Specifically, unlike the original TSST-C where children are requested to complete an unfinished story in front of a committee given only the beginning of the story (Kudielka, Buske-Kirschbaum, Hellhammer, & Kirschbaum, 2004), participants in the current study were designated to re-narrate the story they were given from the research assistant to the audience. This modification was arranged after being tested upon the verification process in a preliminary study.

As shown in Table 4, the psychosocial stress paradigm is

composed of a total of five sessions: one session of saliva sampling-cortisol baseline (5 min), a period of initial story narration (5 min), TSST-C with two consecutive tasks of public speaking (3 min) and a mental arithmetic test (2 min), a quiet waiting time (10 min), and a final session for another saliva sampling-cortisol reaction (5 min). An overview of the psychosocial stress paradigm is illustrated in Table 4, and detailed descriptions of each session are as follows.[1)]

Table 4
An Overview of the Psychosocial Stress Paradigm

	Time of onset	Duration	Brief description
Saliva sampling (baseline)	-10 min (pre-task)	4-5 min	- Instructed to hold a cotton swab in mouth until fully soaked with sufficient saliva; samples are then stored frozen.
Preparation period	-5 min (pre-task)	5 min	- Given a story narration - Informed of a prospective task
TSST-C	0	5 min	- Public speaking (repeat the storytelling task) - Mental arithmetic task (2-digit addition)
Waiting period	+5 min (post-task)	15 min	- Stay in a quiet, separate area for a while (only allowed to do calm, static activities)
Saliva sampling (reaction)	+20 min (post-task)	4-5 min	- Instructed to hold a cotton swab in mouth until fully soaked with sufficient saliva; samples are then stored frozen.

Preparation period Following the first sampling of saliva, children are given a short narrative during a brief preparation period (5 min). The story of a fairy tale was formulated with new,

1) Sessions for saliva sampling will separately be presented in the next section.

unfamiliar contents that children had never heard of, but were still interesting enough to attract their attention. The appropriateness of this newly created narrative has been reviewed by two different teachers in charge of 5-year-old preschoolers and one Ph. D student at the department of child development and family studies who also has experience in teaching preschool children. After the narration, a research assistant informs children about the upcoming storytelling task they would have to accomplish and repeatedly emphasize that they should be as precise and as funny as possible when narrating the story (e.g., *"[Child's name] is going to retell this story to the audience just like I did. But remember, the story should be as precise and funny as possible."*)

Trier Social Stress Test Separated from the preparation area, each child was escorted to an experimental room where a two-adult audience (1 male, 1 female) were sitting on chairs with evaluation forms in hand, and waiting for the child to begin the narration. Research assistants participating as the audience were recruited from graduate or undergraduate students majoring in child development and family studies from Seoul National University.

When a child enters the room, he/she is immediately ushered onto the podium and asked to give a narrative. The audience reminds the child of the need to deliver an exciting narration, as well as a better performance than his/her peers. The female assistant in the audience was instructed to provide a brief guide for inducing the child's storytelling if the child does not say anything for more than 30 seconds (e.g., "*What was the story about?*"; "*What happened to the short girl, Trudy?*"). Both audience members were instructed to maintain a neutral face and avoid positive expressions throughout the task protocol in order to minimize unintended hormonal change (Foley

& Kirschbaum, 2010).

After 3 minutes, the female audience stops the child and presents him/her with subsequent mental arithmetic questions. The audience tells the child that they will be receiving a prize when he/she gives the correct answer, but prizes will not be given if the answers are incorrect. Importantly, the difficulty level of the questions was selected to be slightly higher than what a typical 5-year-old can perform (e.g., "*What is the sum of 12 and 9?*"; "*What is the sum of 11 and 8?*"). The mental arithmetic tasks had been previously graded by teachers in charge of 5-year-old classes, so that the tasks were appropriately designed to challenge the children participating in this study.

Waiting period After 2 minutes, the child is escorted to another quiet, separate area to wait until the designated sampling time. During this time, children are encouraged to stay seated and engage in calm, static activities in order to minimize hormonal fluctuations. When each child's sampling time is reached, he/she then moves to the station of the researcher responsible for saliva collection and finishes the remaining procedure.

The test protocol used in the current study adheres to Dickerson and Kemeny (2004) who proposed a set of determinants known to successfully induce an individual's cortisol response. The three determinants are (a) motivated performance task, (b) uncontrollable task outcome, and (c) social-evaluative threats. In this respect, the TSST is considered as a reliable elicitor that satisfies all three criteria for engendering child's hormone release, and its effectiveness was advocated by numerous researchers (Buske-Kirschbaum et al., 1997; Foley & Kirschbaum, 2010; Gunnar et al., 2009; Kudielka et al., 2004).

(2) Salivary cortisol

Saliva collection was conducted before and after the psychosocial stress paradigm using Salivette devices. In order to secure measurement validity, three prominent factors are determined prior to sampling: (a) time of day, (b) timing of saliva collection, and (c) methods for hormonal assay.

Time of day Release of cortisol complies with a self-sustained, biological oscillation called circadian rhythm, and this endogenous pattern exhibits a period of 24 hours (Gunnar & Quevedo, 2007). In fact, the level of cortisol typically reaches its peak within an hour of awakening, sharply dip down all through the morning hours and progressively approach the lowest diurnal levels across evening (Del Giudice et al., 2011). Thus, in order to control this diurnal variation, all measurements in this study were conducted during hours when hormone release become relatively stable and make plateau, namely between 1pm to 4pm.

Timing of saliva collection Timing of the sampling could also be an important factor in capturing cortisol reactivity since there exists a lag, from the actual stress onset, in distinguishing elevations in cortisol (Dickerson & Kemeny, 2004). Following an acute stressor, there is a minimum latency of about 5 minutes for cortisol increase with peak levels accomplished between 10 and 30 minutes after the onset of stress, demonstrating a slow-response of the activation of HPA axis (Kirschbaum, Pirke, & Hellhammer, 1993). In the current study, the first sample (i.e., baseline) was measured approximately 5

minutes before the initial narration of the researcher during the preparation period, which translates to 10 minutes before the actual TSST begins. Based on the results of the preliminary study, the second sample (i.e., reaction) was collected 20 minutes after the onset of TSST.

Methods for hormonal assay Selecting a method for hormonal assay is another factor that needs to be considered in measuring salivary cortisol. In the current study, a highly sensitive *ECLIA*[2] *(Electrochemiluminescence immunoassay)* that has recently come into the spotlight as an effective diagnostic tool for hormone analysis (Yaneva, Kirilov, Zacharieva, 2009, Yu, 1998) was selected. Unlike typical enzymatic immunoassay techniques (e.g., *ELISA; Enzyme-linked immunosorbent assay)*, the ECLIA is especially advantageous in that it provides a comparable normal range. By comparing the results with normal reference values, it is possible to determine whether or not participants of a certain age display normal levels of cortisol secretion.

Moreover, the current study adopted the single method hormone analysis based on the preliminary findings, which confirmed that the results of the single method are not significantly different from those of the duplicate method.

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2) ECLIA (Electrochemiluminescence immunoassay): 전기화학발광 면역측정법. KIT Product Name: Cortisol, KIT Manufacturer: Roche, Germany, Analyzer Name: Modular anayltics, Analyzer Model: E, Analyzer Manufacturer: Roche, Germany; A biotin-conjugated antibody and a chemiluminescent ruthenium derivative conjugate antibody form a sandwich immunoconjugate. The microparticles bound through the biotin-streptavidin reaction are attached to the electrode by a magnetic force, and the unbound substance is washed do. At the moment when the current is applied to the electrode, chemiluminescence is induced and he signal is measured by the detector. The result is determined by the cut-off value obtained by the correction and the index value calculated by using the signal measured in the specimen (Green Cross LabCell: GCLC).

3. Procedures

1) Preliminary Study

To confirm appropriateness of the psychosocial challenge task and reliability of salivary hormone analysis, a preliminary study was conducted prior to performing the main study. The preliminary study had taken place from September 15th through 20th of 2016 at two different child care centers located in Seoul and Daegu, following the approval of the Seoul National University Institutional Review Board (SNU IRB No. 1609/002-015).

The original version of the Trier Social Stress Test for Children (TSST-C) consists of a 5-minute preparation period, a 5-minute public speaking session, and a 5-minute mental arithmetic task. For public speaking, children only receive the introductory scene of a narrative and are told to complete the remainder of the story by telling it as interesting as possible in front of an audience (Buske-Kirschbaum et al., 1997; Kudielka et al., 2004). However, considering that the TSST-C had previously been performed on Caucasian children ages 9 to 14 years (Buske-Kirschbaum et al., 1997; Kudielka et al., 2004), the current researcher decided to modify the level of task difficulty to be more suitable for 5-year-old Korean preschoolers. To do so, the duration of each section, public speaking and mental arithmetic test, was reduced to 3 and 2 minutes, respectively. Previous findings on meta-analysis have revealed that the total length of the stressor task did not significantly affect the effect sizes of cortisol response (Dickerson & Kemeny, 2004). In addition, the mental arithmetic task given to children in the original version consisted of serial subtraction, such as to subtract 7 from 758

for 9 to 11-year-olds, or to subtract 13 from 1023 for 12 to 14-year-olds. Considering the age of participants in the current study, the researcher modified these questions into the form of two-digit addition (e.g., adding numbers 12 and 9), and tested the tasks for their appropriateness. Prior to the main study, the level of difficulty was assessed and confirmed by teachers of the childcare institutions.

After reconstructing the procedure in the psychosocial stress task, a process for testing the saliva sampling time to capture an accurate peak response followed. A total of 28 children (10 boys and 18 girls) participated in the preliminary saliva sampling procedure. Based on prior research (Buske-Kirschbaum et al., 1997), specimens were collected 5 minutes prior to engaging in the task for examining cortisol baseline, and 10, 20, and 30 minutes after the task for capturing cortisol reaction. Thus, a total of 112 specimens (four specimens from each child) were collected, and then sent to a specialized institution for hormonal analysis. As a result, 21 children among 28 showed a peak response at 20 minutes after-task. Based on these preliminary findings, the sampling times in the current study were determined as 5 minutes prior to the task for baseline, and 20 minutes after-task for reaction. In addition, the applicability of the revised version of the TSST-C had also been confirmed in order to assure that it could elicit an appropriate cortisol response. The results indicated that it was reasonable to carry out the new version.

As for selecting the analytic method for salivary cortisol, 20 specimens were chosen for comparing the results of a single and double method analysis. As a result, it was confirmed that similar results were obtained within the criterion error range. Since the criterion error range is the recommended reason for using the duplicate method (KICCE, 2012), it was judged that there is no

problem in applying the single method analysis in this study.

2) Main Study

The main study was conducted from September 26th to November 2nd of 2016. Prior to visiting each institution, a written consent form for child participation was distributed to all parents of eligible children attending the pertinent child-related institution. Parents were informed that their child would take part in the challenge experiment intentionally designed to induce social stress. Two separate packets were delivered to each of the institutions. One packet for the parents contained a description of the current study, consent form for child participation, a brief questionnaire for mothers, and a gift as compensation for participation in the research. Another packet for the teachers contained the child behavior questionnaires, consent form for participation, and a gift as compensation for participation in the research. Teachers completed behavior checklists for children whose mothers had indicated agreement for her child's participation. After completing the questionnaires to assess each child's temperament and self-initiative behavior, teachers returned the packets to the researcher on her visit to the institution.

At each visit, the researcher was accompanied by three other research assistants. The first assistant played the role of storytelling, and the other two assistants played the role of audience. Prior to the experiment, special directions were given to the participants. In order to improve the reliability and validity of the results, all of the children were advised not to eat, drink, or brush their teeth for at least 45-60 minutes prior to saliva collection to avoid any possible contamination. They were also requested not to engage in physically

or emotionally arousing activities, which may induce unintentional cortisol elevation.

The researcher provided each child with a brief description of the activities that he/she would be participating and proceeded onto the initial saliva sampling for determining baseline cortisol. In order to keep the child's compliance with the saliva collection procedure, the researcher personally demonstrated a process of the collection, instructing and encouraging the child to hold the cotton swab in the mouth for about 4-5 minutes, and to use the tongue to spit out the soaked cotton swab into the plastic tube without using his/her teeth or hands. Collected saliva samples were immediately stored frozen below -20℃ in a box containing solidified carbon dioxide in order to secure optimum temperature. The saliva collection procedure was carried out twice, before and after the TSST task. The frozen specimens were later taken to a laboratory at the Green Cross LabCell (GCLC) where they were assayed by a magnetic particle-based ECL immunoassay.

After completing the final saliva collection, the researcher helped each child to recover from any negative emotion or stress that he/she might have experienced during the psychosocial challenge task. Specifically, the researcher told each child that difficult tasks were mistakenly given to him/her (e.g., "*I made a mistake and gave you the questions that are too difficult for 5-year-old children.*").

The analyzed cortisol data were returned back to the researcher about one week after the commission to the Green Cross LabCell (GCLC). Based on the results provided, the researcher computed the cortisol reactivity scores of the participants, and coded the teachers' response on the questionnaires.

4. Data Analysis

The collected data were analyzed by using the statistical program, IBM SPSS 22.0. In particular, descriptive statistics, t-test, correlation, regression analysis and Sobel test were applied for investigation. Prior to the analysis, items on questionnaires that needed an inverse operation were reverse-coded, and Cronbach's alphas were computed in order to confirm internal consistency and reliability of the scale items. In analyzing the association between temperament, cortisol reactivity and self-initiative behavior, Pearson's correlation test was used. To investigate whether 5-year-old preschoolers' temperament significantly influenced variations in cortisol reactivity and self-initiative behavior, multiple regression analyses were conducted. In order to test whether cortisol reactivity played a mediating role in the relationship between temperament and self-initiative behavior, a hierarchical regression analysis was conducted according to the method proposed by Baron and Kenny (1986). As a final procedure, the Sobel test was used to verify the statistical significance of the mediator effect.

V. Results

This chapter delineates the statistical results of the data analysis, a comparison with relevant findings in preceding research, as well as the interpretation by the researcher. The current section is divided into four parts: 1) descriptive analysis of 5-year-old preschoolers' cortisol reactivity in response to psychosocial challenge tasks; 2) correlation found among principal variables; 3) regression analyses examining the causal relationships among temperament, cortisol reactivity, and self-initiative behavior; and 4) mediation effect of cortisol reactivity.

1. Descriptive Analysis of Preschoolers' Cortisol Reactivity

The general aspect of participants' cortisol reactivity to psychosocial challenge tasks is summarized in Table 5. The average value of preschoolers' pre-task salivary cortisol appeared to be .269μg/dL (SD = .092), and the post-task value was .321μg/dL (SD = .163). To determine whether this change was statistically significant, paired samples t-test was conducted. Results indicated that the difference in the mean salivary cortisol level before and after the task protocol was statistically significant (t = -4.345, p < .001). These results imply that the psychosocial challenges have caused significant changes in the hormone secretion of participants. Previous findings that successfully induced cortisol elevations in preschoolers also support the results of this study (Kudielka et al., 2004). It was previously suggested that children's typical levels of salivary cortisol in preschool settings ranged from .100 to .570μg/dL and averaged .200 μg/dL (Gunnar et al., 1997; Tout, Haan, Campbell, & Gunnar, 1998).

Thus, children who participated in this study seemed to present baseline cortisol levels similar to those presented in the previous study.

Next, preschoolers' cortisol reactivity was recorded by computing the difference between the baseline and 20 minutes after-task salivary cortisol samples (i.e., T2 - T1; Kryski, Smith, Sheikh, Singh, & Hayden, 2001; Sajaniemi, Suhonen, Kontu, Lindholm, & Hiryonen, 2012). Mean cortisol reactivity of the current participants were .052μg/dL (*SD* = .133), with the lowest value of -.150μg/dL and the highest value of .570μg/dL. This result is consistent with the findings of Spinrad et al. (2009), who examined preschoolers' stress reactivity through the assessment of salivary cortisol, as well as salivary alpha-amylase (sAA) following the emotion-eliciting protocol called "not-sharing task." In accordance with current findings, there was an expected pattern of cortisol reactivity with an average increase from the pre-task to the 40-minute post-task salivary cortisol.

Table 5
General Aspect of Cortisol Reactivity

		M	*SD*	Lowest	Highest	Skewness	Kurtosis	*t*
Salivary cortisol	Pre-task	.269	.092	.130	.840	2.485	11.655	-4.345^{***}
	Post-task	.321	.163	.140	1.080	2.179	5.810	
	Reactivity (T2 - T1)	.052	.133	-.150	.570	2.130	5.398	

Note. Unit: μg/dL; T1 = concentration of salivary cortisol measured before the task; T2 = concentration of salivary cortisol measured after the task.
$p < .001^{***}$.

2. Correlation Between Temperament, Cortisol Reactivity, and Self-initiative Behavior among Preschoolers (Research Question 1)

The correlation between temperament (extraversion, negative affectivity, effortful control), cortisol reactivity, and self-initiative behavior (goal-setting, self-practice, self-control) among preschoolers is displayed in Table 6.

Table 6
Correlation Between Temperament, Cortisol Reactivity, and Self-initiative Behavior

	Temperament			Cortisol reactivity	Self-initiative behavior			
	Extraversion	Negative affectivity	Effortful control		Goal-setting	Self-practice	Self-control	Total
1	1							
2	.161	1						
3	-.293**	.104	1					
4	.010	-.279**	.026	1				
5	-.108	-.115	.614***	.221*	1			
6	-.125	.028	.640***	.115	.636***	1		
7	-.347***	-.458***	.510***	.337***	.518***	.528***	1	
8	-.241**	-.255**	.695***	.273**	.834***	.851***	.834***	1

$p < .05^{*}$. $p < .01^{**}$. $p < .001^{***}$.

The results indicate a partial correlation among principal variables. In association between temperament and cortisol reactivity, only negative affectivity was found to be significantly correlated with cortisol reactivity. Specifically, these two constructs showed a negative correlation (r = -.279, p < .01), signifying that with higher temperamental negative affectivity, there was a lower cortisol

reactivity toward a psychosocial challenge task. On the other hand, cortisol reactivity was not significantly correlated with temperamental traits of extraversion, nor with effortful control. This result is in line with numerous findings suggesting that the most closely related temperament to physiological responsiveness is negative affectivity, which includes constructs of fear, anger, sadness, irritability, and frustration (Compas et al., 2004). However, in terms of the degree and direction of the influence, results of comparable precedent findings are rather inconsistent. In accordance with current data, a significant negative correlation between sAA reactivity, an alternative indicator of physiological responsivity, and dispositional anger has been reported for preschool-aged children (Spinrad et al., 2009). A longitudinal study on 7-year-olds, however, presented conflicting outcomes that a child's fearfulness predicted greater cortisol stress reactivity after a 2-year follow-up study (Mackrell et al., 2014).

As expected, all three dimensions of temperament demonstrated significant correlations with self-initiative behavior. Extraversion was negatively correlated with the average score of self-initiative behavior (r = -.222, p < .05), as with the subscale of self-control (r = -.325, p < .01). Negative affectivity showed a significant negative correlation with the average score of self-initiative behavior (r = -.255, p < .01) and self-control (r = -.458, p < .001). Effortful control, on the other hand, was positively correlated with all dimensions of self-initiative behavior, demonstrating a strong interrelation. In particular, effortful control displayed significant positive correlations with goal-setting (r = .580, p < .001), self-practice (r = .600, p < .001), self-control (r = .459, p < .001), and the mean score of self-initiative behavior (r = .661, p < .001). In other words, the higher the preschoolers' temperamental dispositions

in extraversion and negative affectivity, the lower the self-initiative behavior a child displays in the classroom context. Conversely, when a child exhibits a stronger tendency of effortful control, it is more likely that his/her display of self-initiative behavior is higher. This result is supported by previous findings which suggest a significant negative correlation between constructive self-directed behavior with the temperamental component of activity and distractibility, and positive correlations with adaptability and persistence (Landry, Smith, Miller-Loncar, & Swank, 1997). In addition, a study suggesting that children with advanced attentional control may have greater capacity to utilize coping responses that involve controlled shifting of attention (Blair et al., 2011) support the results of the current study on effortful control.

Moreover, a significant positive relationship was revealed linking the association between cortisol reactivity and self-initiative behavior (r = .297, p < .01). Specifically, cortisol reactivity is positively correlated with subfactors of goal-setting (r = .230, p < .05) and self-control (r = .360, p < .01). The result of this finding may be supported via several studies that highlighted the importance of stress response activation for promoting children's adaptation, such as academic performance (Berry, Blair, Willoughby, & Granger, 2012), executive functions (Blair et al., 2011; Obradović, 2016), and school readiness (Obradović et al., 2010). Children demonstrating higher physiological responsivity in the current study may be seen as individuals who were more actively engaged in stress-inducing laboratory task, and thus, were more aroused by (i.e., more aware of) the challenges they faced. This characteristic correlates to the components required in self-initiative behavior in the classroom (Carlson, Mandell, & Williams, 2004; Obradović et al., 2010).

3. Effects of Temperament (Extraversion, Negative Affectivity, Effortful Control) on Cortisol Reactivity and Self-initiative Behavior among Preschoolers (Research Question 2)

Two separate multiple regression analyses were conducted to examine whether children's temperament predicted cortisol reactivity and self-initiative behavior. Participants' sex and birth order variables were included as control variables. Results of previous studies suggest that there may be gender-specific differences in preschoolers' performance on social behaviors (Matthew, Ponitz, & Morrison, 2009; Ponitz et al., 2009; Ready, LoGerfo, Burkam, & Lee, 2005) and that factors related to child birth may affect individuals' innate physiological response propensity through genetic imprinting (Essex, Klein, Cho, & Kalin, 2002; Gutteling, de Weerth, & Buitelaar, 2005; O'Connor et al., 2005).

Above all, several key assumptions required in the multiple regression analysis were reviewed prior to the actual analysis. In an attempt to verify the independence of residuals, Durbin-Watson Statistic was investigated. This specific regression model displayed a value close to 2, which means that there is no autocorrelation in the sample. Moreover, multicollinearity among independent variables was confirmed via two separate methods. First, when computing bivariate correlations between each of the independent variables, correlation coefficients need to be less than 0.8. All three dimensions of temperament, cortisol reactivity, and subfactors of self-initiative behavior were found to exhibit correlations under 0.8, indicating that a presence of multicollinearity is unlikely. Second, existence of multicollinearity can be confirmed by checking the collinearity

statistics in the coefficients table: the Variance Inflation Factor (VIF) and Tolerance. Since VIF and Tolerance have a reciprocal relationship (i.e., TOL = 1/VIF), only one of the indicators is needed. In the current study, the VIFs for all independent variables were examined and confirmed to be less than 10, indicating the absence of multicollinearity.

1) Effect of Temperament on Cortisol Reactivity

Table 7 illustrates the output of multiple regression analysis, measuring the effect of temperament on children's cortisol reactivity.

Table 7
Effect of Temperament on Cortisol Reactivity

Variables			*B*	β	R^2	Adj. R^2	*F*
Cortisol reactivity	Constant		-.004 (.129)				
	Control variables	Sex	.010 (.031)	.039	.111	.073	2.925*
		Birth order	.022 (.014)	.158			
	Independent variables	Extraversion	.015 (.019)	.082			
		Negative affectivity	-.050 (.018)	-.261**			
		Effortful control	.021 (.027)	.082			

$p < .05^{*}$. $p < .01^{**}$.

Results indicate that the corresponding model retains 7.3% explanation power, demonstrating a significance level of $p < .05$. Namely, preschoolers' temperament with control variables predicted 7.3% of the total variance in cortisol reactivity ($F = 2.925$, $p < .05$). Of the three dimensions of temperament, negative affectivity was the only one that significantly predicted children's cortisol reactivity. The regression coefficient of negative affectivity was significant (β =

−.261, $p < .01$) even after administering sex and birth order as control variables, indicating its critical independent influence. In particular, negative affectivity exerted a notable negative effect on cortisol reactivity, indicating that the higher the children's negative affectivity, the lower the cortisol reactivity. On the other hand, preschoolers' propensities in extraversion and effortful control were not predictive of cortisol reactivity.

As mentioned earlier, this result can be understood in the same context as that temperamental tendencies toward negative emotional states represent the most closely related disposition to physiological stress response (Compas et al., 2004). However, this is in contrast to reports presenting greater increases in cortisol levels from midmorning to midafternoon in childcare settings for children who exhibit stronger negative emotional temperament (Watamura, Sebanc, & Gunnar, 2002). A reduction in cortisol reactivity, according to this study, indicates that there is a higher tendency for children to decrease their vigilance against assaults, rather than to become more aroused. Thus, the current finding suggests that negative affects in preschoolers may lower their vigilance toward psychosocial challenges, exhibiting decreased cortisol reactivity.

Taken together, this result signifies that children's physiological response to environmental threats and challenges may be influenced by the individual's unique characteristics in temperament.

2) Effect of Temperament on Self-initiative Behavior

Results of the multiple regression analysis measuring the effect of temperament on self-initiative behavior among preschoolers are displayed on Table 8.

Table 8
Effect of Temperament on Self-initiative Behavior

Variables			*B*	β	R^2	Adj. R^2	*F*
Self-initiative behavior	Constant		1.948 (.303)				
	Control variables	Sex	.007 (.072)	.008	.595	.578	34.396***
		Birth order	-.020 (.033)	-.042			
	Independent variables	Extraversion	.023 (.044)	.035			
		Negative affectivity	-.230 (.042)	-.350***			
		Effortful control	.666 (.063)	.733***			

$p < .001$***.

Results indicate that the corresponding model retains 57.8% explanation power, demonstrating a significance level of $p < .001$. Thus, temperament, together with control variables, predicted 57.8% of the total variance in children's self-initiative behavior ($F = 34.396$, $p < .001$). Of the three dimensions of temperament, negative affectivity and effortful control significantly predicted children's self-initiative behavior. Regression coefficients of negative affectivity (β = -.350, $p < .001$) and effortful control (β = .733, $p < .001$) turned out to be significant after administering control variables, indicating their independent influences.

Negative affectivity, as in the case of cortisol reactivity, exerted a significant negative influence over children's execution of self-initiative behavior. Considering that dispositions toward negative

emotions may function as an important temperamental precursor for a later display of emotional and behavior problems (Henderson et al., 2001), it may be the case that this tendency brought about significant adverse effects on their abilities to plan, practice and control one's own behavior effectively.

Effortful control, on the other hand, appeared to positively influence children's self-initiative behavior observed in the classroom. This is in line with the previous findings that highlighted some of the positive aspects of attention-regulating capacities (Lengua & Long, 2002; Rothbart & Jones, 1998; Yagmurlu & Altan, 2010). Based on the flexible, deliberate inhibition of impulses and perceptual competency (Eisenberg et al., 2004), children are allowed to use adaptive, effective coping strategies, and effectively control their own emotions and behaviors. The result of the current study implies that children's ability to self-initiate in the face of new demands and expectations may arise with the capacity to control attention, inhibit impulses, and initiate appropriate actions by suppressing dominant responses.

4. Mediation Effect of Cortisol Reactivity in Association Between Temperament and Self-initiative Behavior among Preschoolers (Research Question 3)

In the final analysis, hierarchical multiple regression was conducted to verify the mediation effect of children's cortisol reactivity on the association between temperament and self-initiative behavior. In consideration of gender differences and birth order effects, sex and birth order were additionally put into the model as control variables.

Several key assumptions required in the multiple regression analysis were reviewed prior to the actual analysis. In an attempt to verify the independence of residuals, Durbin-Watson Statistic was investigated. This specific regression model displayed a value close to 2, which means that there was no autocorrelation in the sample. Moreover, multicollinearity among independent variables was confirmed using two separate methods. First, when computing bivariate correlations between each of the independent variables, correlation coefficients need to be less than 0.8. All three dimensions of temperament, cortisol reactivity, and subfactors of self-initiative behavior were found to exhibit correlation values under 0.8, indicating that a presence of multicollinearity is unlikely. Second, existence of multicollinearity can be confirmed by checking the collinearity statistics in the coefficients table: Variance Inflation Factor (VIF) and Tolerance. Since VIF and Tolerance have a reciprocal relationship (i.e., TOL = 1/VIF), only one of the indicators needed to be used. In the current study, VIFs for all independent variables were examined, and confirmed to be less than 10, indicating the absence of multicollinearity.

In verifying the mediation effect of cortisol reactivity, a protocol

suggested by Baron & Kenny (1986), which proposed properties of mediator variables at a number of levels, was administered. According to Baron & Kenny (1986), the mediation model is established on the basis of three-variable system; two introductory pathways feed into one consequential variable. A variable functions as a mediator when it satisfies three requirements. First, variations in stages of the independent variable significantly account for variations in the mediator. Thus, variations in children's cortisol reactivity must be explained by variations in children's temperament. Second, variations in the mediator significantly account for variations in the dependent variable. Thus, cortisol reactivity must exert significant influence on variations in children's self-initiative behavior. Third, when both independent and mediator variables are considered, the mediator significantly influences the dependent variable. In other words, when temperament and cortisol reactivity are both invested in regression model, cortisol reactivity must demonstrate a significant effect over self-initiative behavior. When a previously significant association between an independent and dependent variable is no longer significant, a complete mediation occurs, indicating a functional significance of a single, dominant mediator. When a previously significant association between independent and dependent variable is still present, but the level of significance has decreased to a certain degree, a partial mediation is said to be present, indicative of the operation of multiple mediating factors linking the two (Baron & Kenny, 1986).

Results of the previous regression analysis indicate that among the three dimensions of temperament, only negative affectivity significantly predicted variations found in cortisol reactivity. Considering the requirements of the mediation analysis, only negative

affectivity was applied for a final mediation analysis. Therefore, children's negative affectivity must predict variations in cortisol reactivity and self-initiative behavior.

Table 9
Mediation Effect of Cortisol Reactivity in Association Between Negative Affectivity and Self-initiative Behavior

Variables		Model 1	Model 2	Model 3
		Self-initiative behavior	Cortisol reactivity	Self-initiative behavior
		β	β	β
Control variables	Sex	.379***		
	Birth order	-.238**		
Independent variable	Negative affectivity	-.349***		
Control variable	Sex		.043	
	Birth order		.146	
Independent variable	Negative affectivity		-.243**	
Control variables	Sex			.368***
	Birth order			-.271**
Independent variable	Negative affectivity			-.293**
Mediating variable	Cortisol reactivity			.231**
Constant		4.091 (.227)	.111 (.070)	4.002 (.224)
R^2		.207	.102	.254
Adj. R^2		.187	.080	.229
R^2 change		-	-	.048**
F		10.327***	4.517**	10.064***

$p < .05^{*}$. $p < .01^{**}$. $p < .001^{***}$.

Table 9 delineates the results that verify the mediation effect of cortisol reactivity linking the association between temperamental negative affectivity and self-initiative behavior. Hierarchical multiple regression analysis was performed on a three-step research model;

sex and birth order were designated as control variables and negative affectivity was selected as an independent variable. Step 1 includes a research model investigating the independent influence of negative affectivity over self-initiative behavior when child sex and birth order are controlled for. The explanation power of this model was found to be 18.7% ($p < .001$).

Step 2 examines the relation between negative affectivity and cortisol reactivity, that is, between the independent and mediator variables. As in Step 1, the independent influence of negative affectivity on cortisol reactivity was computed by controlling variances in sex and birth order. The explanation power was 8.0% ($p < .01$).

Step 3 involves a research model that includes both negative affectivity and cortisol reactivity for assessing their impact on self-initiative behavior while considering sex and birth order effects. The explanation power is 22.9% ($p < .001$). Compared with the first model computing the influence of negative affectivity, there was a change of .048 in the explanation power, a difference that was statistically significant ($p < .01$). Therefore, adding children's cortisol reactivity into the equation significantly improved the explanation power in defining variance in children's self-initiative behavior.

Next, results that verified the mediating effect of cortisol reactivity in preschoolers will be presented. In order to confirm the mediating role in children's cortisol reactivity, conditions for establishing the parameters must be satisfied in the three-step research model. First, it was confirmed that negative affectivity, the independent variable, had a significant effect on self-initiative behavior, the dependent variable ($\beta = -.349$, $p < .001$; Step 1). The second condition was that negative affectivity, the independent variable, must exert a significant

influence over cortisol reactivity, the mediator. This condition has also been satisfied (β = -.243, $p < .01$; Step 2). Finally, cortisol reactivity significantly predicted variances in self-initiative behavior when computed with negative affectivity (β = -.293, $p < .01$), and the effect size of negative affectivity was reduced, but still found to be statistically significant. Thus, the partial mediation effect of cortisol reactivity was verified (Step 3). The Sobel test was conducted to test the statistical significance of this mediation effect, and the corresponding result was found to be significant (two-tailed; z = -1.97, $p < .05$).

In sum, cortisol reactivity of 5-year-old preschoolers was proved to partially mediate the effects of negative affectivity on their execution of self-initiative behavior. Current findings suggest that stronger temperamental tendencies toward negative affects lower the physiological responsivity through diminished cortisol reactivity, and the declined responsivity subsequently reduces the execution of self-initiative behavior. Thus, heightened physiological responsivity can be interpreted as a buffering factor leading to more adaptive and effective self-initiating behaviors in the context involving social challenges. It is also suggested that certain temperamental characteristics are especially more influential in affecting children's physiological stress regulation.

The mediating effect of cortisol reactivity in association between negative affectivity and self-initiative behavior is shown in Figure 1.

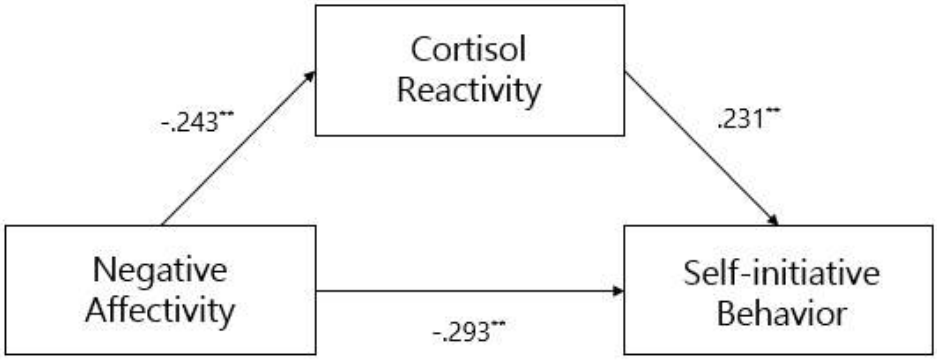

Figure 1. Mediation effect of cortisol reactivity in association between negative affectivity and self-initiative behavior.
$p < .01^{**}$.

VI. Discussion

The current study focuses on preschoolers' self-initiative behavior that functions as an adaptive competency in an institutional environment. While extant research emphasizes the need for children to behave as proactive being in their own lives, the role of self-initiative behaviors and related variables functioning in a social environment has greatly been neglected. Thus, this research looks into the self-initiative behavior of 5-year-old preschoolers in a socio-defiant context of classrooms, taking into account children's temperamental characteristics, which are known to significantly affect behavioral outcome. Based on the Adaptive Calibration Model (ACM) of the physiological stress response system (Del Giudice et al., 2011), it is hypothesized that one's embedded physiological responsivity may function as a significant mediating variable in the association between temperament and self-initiative behavior.

In order to accomplish these research objectives, 125 5-year-old preschoolers attending childcare centers and kindergartens located in Seoul, Kyeonggi and Daegu regions were selected as participants. Based on the research questions, preschoolers' temperamental characteristic and self-initiative behaviors were assessed using teacher-rated checklists, and the value of cortisol reactivity was calculated using the change in salivary cortisol levels before and after the administration of a psychosocial challenge task. Collected data were analyzed using SPSS 22.0, and the following conclusions were based on major findings.

First, among the three dimensions of temperament, negative affectivity directly influenced preschoolers' cortisol reactivity and self-initiative behavior. In specific, a higher tendency to experience

negative emotions reduced the cortisol reactivity to psychosocial challenge, as well as children's execution of self-initiative behavior in a socially challenging context. Findings can readily be discussed in the same context with studies proposing that temperamental characteristics predict differential experience of a social environment, and that contextually identical stimuli can be processed differently according to individual dispositions in temperament (Rothbart & Jones, 1998). Since negative affectivity is regarded as a particular "diathesis" or "vulnerability" which may lead to numerous behavior problems and defects in self-regulation (Kim & Kochanska, 2012; Lahey et al., 2008; Sanson, Hemphill, & Smart, 2004), self-initiative behavior with a required capacity for deliberative self-control, self-reactiveness, and self-reflection must have been less observed among children who experience stronger negative affects.

Temperamental vulnerability toward various types of negative affects such as irritation, anger, fear and sadness may reduce preschool-aged children's physiological responsivity. Affectivity such as displeasure and frustration may make cognitive processing of environmental information more difficult (Rothbart & Jones, 1998). In light of this point, children with higher levels of negative affectivity may have had a lower understanding of the challenging characteristics of the psychosocial stress task provided in the current research, and thus, exhibited lower levels of physiological arousal, reflecting passive involvement and coping to stress (Segerstrom & Miller, 2004). In fact, the pattern of diminished responsivity is more likely to be constructed upon accumulated past experiences from a child's tendency to experience negative affects more frequently and easily, or is likely to reflect physiological phenotype with genetic origins (Del Giudice et al., 2012) rather than an immediate result revealed in the experimental setting. Prior research based on

preschool children and adults also reported that negative affectivity predicts the slower decline of cortisol in the afternoon (Adam, Hawkley, Kudielka, & Cacioppo, 2006; Dettling, Gunnar, & Donzella, 1999). Given that cortisol reactivity in this research is measured as the difference in hormone levels before and after the task, low reactivity may reflect the tendency for a slower and flatter cortisol decline.

Second, among the three dimensions of temperament, extraversion and effortful control displayed completely different results. Although extraversion displayed a significant negative correlation to self-initiative behavior, it was not a significant predictor of self-initiative behavior. Effortful control, on the other hand, strongly predicted a child's execution of self-initiative behavior in the classroom context. The result supports the claim of prior research that effortful control is a fundamental attribute in self-regulation (Rothbar & Jones, 1998), and is closely linked to flexible activity of the anterior attention system that governs the control of reflective behavior (Posner & Rothbart, 2000). This illustrates the importance of promoting better capacity to control attention, inhibit impulses, and suppress dominant responses in order to cultivate self-initiative behavior.

With regards to the cortisol reactivity, however, both extraversion and effortful control failed to predict responsivity toward a psychosocial challenge task. It was previously hypothesized that individuals lying at different points on dimensions of personality have variations in underlying biological systems, usually in their regulation of key neurotransmitters (Munafò et al., 2006). Since stress response is mainly derived from trait anxiety or vulnerability to affective disturbance (Jezova, Makatsori, Duncko, Moncek, & Jakubek, 2004), the relationship with negative affectivity reflecting these

characteristics may have appeared to be a prominent temperamental trait.

Third, preschoolers' cortisol reactivity partially mediated the association between temperamental negative affectivity and self-initiative behavior. In other words, when children's sex and birth order are controlled for and cortisol reactivity on the relation between negative affectivity and self-initiative behavior is jointly considered, effects of negative affectivity is partially reduced. This result confirms the argument of the ACM that the human physiological stress response may affect a large number of areas in development by mediating the organism's openness towards information delivered by the environment (Del Giudice et al., 2011). Children who are relatively less vulnerable to negative affects may increase their sensitivity towards a context by displaying physiologically high levels of arousal, which consequently leads to the development of self-initiative behavior. On the other hand, children who experience feelings of irritation, anger, fear and sadness more often and intensely due to the accumulation of repeated negative experiences may have a lower biological sensitivity towards a context. Therefore, self-initiative behavior displayed in the socio-defiant context of classrooms may also decline. Accordingly, this result implies that the experience of negative affectivity needs to be minimized in order to promote proactive, autonomous, self-leading behavior in preschoolers.

Given that the human physiological stress response is a complex multi-dimensional concept, caution is needed in interpreting the difference between high and low levels of cortisol reactivity as simply resulting from under- or over-experience of stress. From perspectives of the Differential Susceptibility to Context Theory (DSCT) and the Adaptive Calibration Model (ACM), physiological stress response is a developmentally acquired phenotype and is characterized by

malleability and plasticity, developed in ways to favor adaptation in each individual (Del Giudice et al., 2011). In light of this notion, children who are relatively more vulnerable to negative affectivity can be seen as promoting adaptability by mitigating effects of the negative environment by becoming physiologically "under-aroused," while children with low negative affectivity increase their own adaptability by strengthening their alertness towards a threat by displaying "high arousal".

In this regard, activation of the physiological stress response can be considered from two contrasting perspectives. First, there exists a negative view that considers increased cortisol levels resulting from heightened activity of the HPA axis as a failure to cope with stress (Levine & Wiener, 1988; Spangler & Scheubeck, 1993). According to this perspective, children with high cortisol reactivity are those who fail to overcome stressful situations they face and such anxiety is reflected in their physiological response. Conversely, from the positive perspective that considers increased cortisol levels as a reflection of organism's active coping and engagement to overcome and adapt to stress, strengthened physiological response is considered a dominant and assertive behavior (Hellhammer, Buchtal, Gutberlet, & Kirschbaum, 1997; Manogue, Leshner, & Candland, 1975).

Considering that the result of the current study indicates that heightened physiological reactivity was promotive of the development of self-initiative behavior, cortisol arousal appears to reflect children's allocation of attentional resources, internal cognitive processes, and active engagement (Spinrad et al., 2009). Thus, the present study supports the positive perspective on the activation of the physiological stress response system. Increased cortisol reactivity, in this perspective, represents children's assertion or management of unfair treatment of social tasks (Spinrad et al., 2009), rather than the failure

to cope with these challenges.

This research has reached the aforementioned conclusion by investigating preschoolers' temperament, self-initiative behavior, as well as the role of cortisol reactivity as a physiological mediator. The implications are as follows.

First, the present study benefited from the examination of preschoolers' self-initiative behavior from a social aspect by supplementing limitations of prior research that focused either on children's play initiative or learning initiative targeted at school-aged children. By verifying the functional significance of increased openness toward positive environment while minimizing the experience of negative affectivity in order to construct such responsivity, the current study proposed the need for an individualized approach that takes into account the individual variations in children's temperamental and physiological characteristics in the child rearing context.

Second, the current study offers methodological implications by including highly reliable and valid measurements of physiological data using salivary hormone analysis that is widely adopted in the field of neuroendocrinology based on its advantageous attributes of easy collection and analysis. Prior research is limited to the observer's subjective judgement on children's behavioral responses to stress. Physiological data used in this study successfully avoided this pitfall of most prior studies.

Third, this research provides positive implications on the proper levels of stress by focusing on the adaptive, regulative functions of the physiological stress response system. While much of the extant research explores the pattern of physiological stress response and the level of accumulated stress caused by individual and environmental factors, they are limited in that they fail to identify the effects of this

differential responsivity on the positive outcome. By extending a prior research that has considered the negative aspects of stress such as depression, anxiety, externalization and internalization (Shirtcliff, Granger, Booth, & Johnson, 2005), this research gives a positive, meaningful implication on the activation of the stress response system, exploring the benefits of such characteristic on preschoolers' self-initiative behavior.

Fourth, this study offers implications for inducing children's cortisol reactions by adopting the TSST, an experiment that is increasingly recognized in research on the physiological stress response. Extant research typically identifies irregular patterns and abnormal levels of cortisol secretion by investigating the levels and changes of hormone in baseline conditions in the absence of stimulation. The current research verified preschoolers' differential responsivity at the physiological level toward a task involving properties of uncontrollability, social-evaluative threats and obstruction towards goal achievement.

Interpretation of the present findings is limited in the following aspects, thereby providing suggestions for future research. First, the current research was unable to consider the quality of the child's rearing environment in measuring the effects of temperament on the physiological stress response. Prior research proposes psychological characteristics such as parenting behavior, parent-child attachment security, and mother's anxiety or depression as variables that may affect the formation of children's physiological stress response (Bernard & Dozier, 2010; Loman & Gunnar, 2010; Mackrell et al., 2014). In order to complement this limitation, future research needs to consider the quality of the child's rearing environment when identifying physiological stress reactivity and patterns of self-initiative behavior.

Second, this research is limited in its inability to capture the features of cortisol recovery (Dickerson & Kemeny, 2004) after the termination of the psychosocial challenge task. A hormonal trajectory recovering back to the baseline after the administration of a stress task has not been traced in the current study. Future research may need to increase precision and provide richer interpretations of hormonal responsivity by collecting additional saliva at the cortisol recovery phase.

Third, children's temperament and self-initiative behavior were measured based on the teachers' response instead of a direct observation of the children. It is possible that teachers' subjective point-of-view may have interfered in the process of accurate assessment of children's temperament and self-initiative behavior. Future research may need to conduct more objective measurements using methods such as face-to-face interview or direct observation.

Despite these limitations, the current study contributes both methodologically and theoretically to the understanding of the mediating effect of physiology on the temperament-behavior relationship.

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APPENDIX 1 (Korean Ver.)

질 문 지

<교 사 용>

안녕하십니까?
저는 서울대학교 아동가족학과 석사과정에 재학 중인 은선민입니다.
바쁘신 가운데 귀한 시간을 할애해 주셔서 깊은 감사를 드립니다.

본 질문지는 평소 아이가 어린이집 또는 유치원에서 보이는 행동을 알아보기 위한 것입니다. 응답하신 내용은 학문적인 목적 외에는 어떤 곳에도 사용하지 않을 것이며, 연구자 외의 타인에게 절대 공개되지 않을 것임을 약속드립니다.

한 문항도 빠뜨리지 마시고 모든 문항에 답하여 주셔야만 자료로서의 가치가 있으므로 이 점에 유의해서 질문지를 작성해 주시기를 부탁드립니다. 선생님의 솔직한 답변은 연구에 귀중한 자료가 될 것입니다.
적극적인 협조에 다시 한 번 감사의 말씀을 드립니다.

2016년 9월
서울대학교 아동가족학과 석사과정
은 선 민 올림
연락처 : [redacted]

1. 선생님의 교사 경력은 얼마입니까?
(_____년_____개월)

2. 현재 선생님의 학급에서 함께 생활하는 아동과 교사 수는 몇 명입니까?
(교사 _____명)
(아동 _____명)

3. 근무하고 계신 기관의 종류는 무엇입니까?

3-1. 근무하고 계신 기관이 유치원일 경우,

☐ ①국립 유치원
☐ ②병설 유치원
☐ ③단설 유치원
☐ ③사립(민간) 유치원
☐ ⑤기타(_____)

3-2. 근무하고 계신 기관이 어린이집일 경우,

☐ ①국·공립 어린이집
☐ ②민간 어린이집
☐ ③가정 어린이집
☐ ④직장 어린이집
☐ ⑤기타(_____)

❖ 유아 이름: _____ (남아 , 여아)

❖ 유아 생년월일: _____ 년 _____ 월 _____ 일 (만 _____ 세)

❖ 기관명: _____ 학급명: _____ 관찰자: _____

❖ 다음은 유아의 기질을 알아보기 위한 문항입니다. 각 질문의 내용을 보고, 아이가 평소 보이는 행동을 생각하시어 솔직하게 응답해 주십시오.

	문항	전혀 그렇지 않다	그렇지 않은 편이다	가끔은 그렇다	그런 편이다	항상 그렇다
1	한 곳에서 다른 곳으로 옮길 때 급하게 서두르는 편이다.	1	2	3	4	5
2	자신이 원하는 것을 못하게 했을 때 매우 좌절한다.	1	2	3	4	5
3	그림을 그리거나 색칠을 할 때, 집중을 잘 한다.	1	2	3	4	5
4	조금만 다쳐도(작은 상처나 멍) 매우 속상해한다.	1	2	3	4	5
5	높은 미끄럼틀에서 내려오는 등 위험한(모험적인) 활동을 좋아한다.	1	2	3	4	5
6	견학을 가거나 야외활동을 할 때 자신이 원하는 것을 계획해서 준비한다.	1	2	3	4	5
7	새로운 상황에서 성급하게 행동하는 경우가 종종 있다.	1	2	3	4	5
8	누군가가 노래불러주는 것을 좋아한다.	1	2	3	4	5
9	선생님이나 친구가 새로운 옷을 입으면 알아차린다.	1	2	3	4	5
10	어떤 사람과도 잘 지내는(어울리는) 편이다.	1	2	3	4	5
11	활동적인 게임보다는 조용한 활동을 좋아한다.	1	2	3	4	5
12	뭔가를 쌓거나 만들 때, 매우 집중해서 긴 시간동안 작업한다.	1	2	3	4	5
13	우리 반이 계획했던 것이 실행되지 않으면 슬퍼하는 편이다.	1	2	3	4	5
14	그네를 탈 때 높이, 빨리 밀어주는 것을 좋아한다.	1	2	3	4	5
15	선생님의 지시를 잘 따른다.	1	2	3	4	5

16	도둑이나 귀신을 무서워한다.	1	2	3	4	5
17	새로운 상황에 적응하는데 시간이 많이 걸린다.	1	2	3	4	5
18	화가 나는 일이 있을 때, 10분 이상 화가 지속된다.	1	2	3	4	5
19	종종 오랫동안 알고 지낸 사람들 사이에서도 수줍어한다.	1	2	3	4	5
20	하루 종일 지치지 않고 에너지가 넘친다.	1	2	3	4	5
21	동요처럼 가사가 있는 노래를 좋아한다.	1	2	3	4	5
22	거칠고 난폭한 활동을 좋아한다.	1	2	3	4	5
23	어떤 과제를 해내지 못했을 때 우울해하는 편이다.	1	2	3	4	5
24	교실에 새 물건이 있으면 빨리 알아차린다.	1	2	3	4	5
25	다음 일을 결정할 때 천천히 서두르지 않는다.	1	2	3	4	5
26	종종 그림책에 푹 빠져 오랫동안 책을 읽는다.	1	2	3	4	5
27	감기로 아플 때도 별로 불평하지 않는다.	1	2	3	4	5
28	위험하다고 얘기한 장소에는 천천히 조심스럽게 접근한다.	1	2	3	4	5
29	종종 새로운 사람을 만나면 부끄러워서 (수줍어서) 외면한다.	1	2	3	4	5
30	의자를 흔들어주거나 살짝 흔들며 달래주거나 재워주는 등 부드러운 리듬이 있는 활동을 좋아한다.	1	2	3	4	5
31	선생님이나 친구의 외모에 변화가 생기면 이에 대해 이야기를 한다.	1	2	3	4	5

❖ **다음은 아이가 어린이집 또는 유치원에서 보이는 행동을 살펴보기 위한 문항입니다. 각 질문의 내용을 보고, 아이가 평소 보이는 행동을 생각하시어 솔직하게 응답해 주십시오.**

	문항	전혀 그렇지 않다	그렇지 않은 편이다	가끔은 그렇다	그런 편이다	항상 그렇다
1	놀이를 하기 전에 놀이계획을 세운다.	1	2	3	4	5

2	아침에 등원하면 무엇부터 해야 할지 알고 있다.	1	2	3	4	5
3	놀이를 계획할 때 우선적으로 해야 할 놀이를 먼저 정한다.	1	2	3	4	5
4	과제를 하기 전 무엇을 먼저 해야 할지 정할 줄 안다.	1	2	3	4	5
5	그림그리기(과제)를 완성하기 위해 필요한 방법을 찾을 수 있다.	1	2	3	4	5
6	도움이 필요하면 친구나 선생님에게 요청할 수 있다.	1	2	3	4	5
7	가족의 소중함을 안다.	1	2	3	4	5
8	건강(신체)의 소중함을 안다.	1	2	3	4	5
9	친구의 소중함을 안다.	1	2	3	4	5
10	음식의 소중함을 안다.	1	2	3	4	5
11	밥 먹기 전에 해야 할 일들을 알고 있다.	1	2	3	4	5
12	목표를 달성하기 위해 해야 할 일들을 체크한다.	1	2	3	4	5
13	놀이 하던 도중에 다른 새로운 놀이가 있으면 하던 놀이를 포기한다.	1	2	3	4	5
14	놀이가 재미없을 때 새로운 놀이방법을 시도한다.	1	2	3	4	5
15	블록을 높이 쌓기 위해 블록 쌓기를 여러번 시도한다.	1	2	3	4	5
16	옷 입기가 힘든 옷이라도 끝까지 혼자 옷을 입으려고 시도한다.	1	2	3	4	5
17	자신이 만든 작품에 대해 설명한다.	1	2	3	4	5
18	만들기 했던 것을 활용하여 다른 것을 만들어 본다.	1	2	3	4	5
19	행동하기 전에 미리 생각을 먼저 한다.	1	2	3	4	5
20	과제를 시작하기 전에 어떻게 할 것인지를 말한다.	1	2	3	4	5
21	그림을 그릴 때 상상해 본 후 그림을 그린다.	1	2	3	4	5
22	새로운 과제에 도전할 때 미리 어떻게 될지 상상으로 연습해 보고 시도한다.	1	2	3	4	5
23	전에 했던 일을 참고로 일을 진행한다.	1	2	3	4	5
24	다른 친구가 했던 좋은 점을 알고 있으	1	2	3	4	5

	며 그 점을 참고한다.					
25	화가 나도 참고 침착하게 요구한다.	1	2	3	4	5
26	감정의 변화가 심하다.	1	2	3	4	5
27	속상할 때는 “나 기분 나빠”라고 말로 이야기 한다.	1	2	3	4	5
28	기쁠 때는 “기분이 좋아”라고 말로 이야기 한다.	1	2	3	4	5
29	게임에서 지면 “내가 졌어”라고 결과를 인정한다.	1	2	3	4	5
30	게임에서 지면 이긴 친구(편)를 축하해 준다.	1	2	3	4	5
31	집단 활동에 집중하지 못한다.	1	2	3	4	5
32	앉아서 하는 활동을 좋아하지 않는다.	1	2	3	4	5
33	과제가 잘 되지 않을 때 화를 내거나 짜증을 낸다.	1	2	3	4	5

❖ **한 문항도 빠뜨리지 마시고 모든 문항에 답하여 주셔야만 자료로서의 가치가 있습니다. 빠뜨린 문항은 없는지 다시 한 번 확인해 주시기를 부탁드립니다.**

- 감사합니다 -

APPENDIX 1 (English Ver.)

ID | (Leave as blank) |

Questionnaire

<For teachers>

Hello. My name is Sunmin Eun, a student enrolled in the master's program in the Department of Child Development and Family Studies at Seoul National University.

The purpose of this questionnaire is to explore children's everyday behavior at the childcare center or kindergarten. Your responses will only be used for academic purposes and will be strictly confidential, disclosed only to researchers. This questionnaire will only be valuable as data when all questions have been completely answered. So, I sincerely ask that you complete this survey with this in mind.

Once again, your cooperation is greatly appreciated.

Yours sincerely,

Sunmin Eun
Dept. of Child Development and Family Studies
Seoul National Univeristy

Contact number : [redacted]

1. For how many years have you been a teacher?

(_____year(s)____months(s))

2. How many children and teachers are currently in your class?

(Teachers _____명)

(Children _____명)

3. What type of institution do you work at?

3-1. if you work at a kindergarten, is it:

- ☐ ① A state kindergarten
- ☐ ② A public kindergarten attached to a primary school
- ☐ ③ An independent public kindergarten
- ☐ ④ An independent private kindergarten
- ☐ ⑤ Other (_____)

3-2. if you work at a childcare center, is it:

- ☐ ① A state/public childcare center
- ☐ ② A private/civilian childcare center
- ☐ ③ A home childcare center
- ☐ ④ A childcare center attached to or affiliated with a workplace
- ☐ ⑤ Other (_____)

❖ Name of child: _____ (boy , girl)

❖ Date of birth: _____(month)_____(day), _____(year)(age: _____ in full)

❖ Name of institution: _____ Name of class: _____

❖ Observer: _____

❖ The following are questions exploring the child's temperament. Your responses will be strictly confidential, disclosed only to researchers. Please answer each question frankly in terms of the child's usual behavior.

	Items	never or almost never	not often	some times	often	always or almost always
1	This child tends to rush impatiently when he/she moves from one place to another.	1	2	3	4	5
2	This child becomes very frustrated when he/she is stopped from doing what he/she wants to do.	1	2	3	4	5
3	This child concentrates well when he or she draws or colors a picture.	1	2	3	4	5
4	This child becomes very upset even when he/she is injured only slightly (slight wounds or bruises).	1	2	3	4	5
5	This child likes risky (or adventurous) activities such as sliding down a tall playground slide.	1	2	3	4	5
6	This child plans and prepares what he/she wants to do when he/she goes on a field trip or engages in an outdoor activity.	1	2	3	4	5
7	This child often behaves rashly in new situations.	1	2	3	4	5
8	This child likes to have others sing to him/her.	1	2	3	4	5
9	This child notices when teachers or friends are wearing new clothes.	1	2	3	4	5
10	This child tends to be on good terms with (or gets along with) everyone.	1	2	3	4	5
11	This child prefers quiet activities to active games.	1	2	3	4	5
12	This child concentrates very hard and works for a long time when he/she stacks up or builds something.	1	2	3	4	5
13	This child tends to become sad when class plans are not executed.	1	2	3	4	5

14	This child likes to be pushed high up and fast when he/she is seated on a swing.	1	2	3	4	5
15	This child follows teachers' instructions well.	1	2	3	4	5
16	This child is afraid of thieves or ghosts.	1	2	3	4	5
17	This child takes a long time to adjust to new situations.	1	2	3	4	5
18	This child remains angry for 10 minutes or more when he/she is angered by something.	1	2	3	4	5
19	This child is often shy even around people whom he/she has known for a long time.	1	2	3	4	5
20	This child is full of energy all throughout the day without getting tired.	1	2	3	4	5
21	This child likes songs with lyrics such as children's songs.	1	2	3	4	5
22	This child likes rough and violent activities.	1	2	3	4	5
23	This child tends to get depressed when he/she fails to complete a task.	1	2	3	4	5
24	This child quickly recognizes when there are new objects in the classroom.	1	2	3	4	5
25	This child does not hurry and takes time when he/she decides what to do next.	1	2	3	4	5
26	This child is often engrossed in picture books, reading them for a long time.	1	2	3	4	5
27	This child does not complain very much even when he/she is sick with a cold.	1	2	3	4	5
28	This child slowly and carefully approaches places that he/she has been told are dangerous.	1	2	3	4	5
29	This child often ignores strangers out of shyness.	1	2	3	4	5
30	This child likes gentle, rhythmic activities such as being rocked in a chair, being lulled or put to sleep with a gentle rocking motion.	1	2	3	4	5
31	This child talks about changes in his/her teachers' or friends' appearances.	1	2	3	4	5

❖ Following are questions exploring the child's behavior at the childcare center/kindergarten. Your responses will be strictly confidential, disclosed only to researchers. Please answer each question frankly in terms of the child's usual behavior.

	Items	never or almost never	not often	some times	often	always or almost always
1	The child makes plans before he/she plays a game.	1	2	3	4	5
2	This child knows what must be done first after he/she arrives at the kindergarten (or the childcare center).	1	2	3	4	5
3	This child decides which game to play first when he/she plans games.	1	2	3	4	5
4	This child is able to decide what to do first before he/she performs a task.	1	2	3	4	5
5	This child is able to find the methods necessary for finishing a drawing (or a task).	1	2	3	4	5
6	This child is able to ask his/her friends or teachers when he/she needs help.	1	2	3	4	5
7	This child knows the value of family.	1	2	3	4	5
8	This child knows the value of health (or the body).	1	2	3	4	5
9	This child knows the value of friends.	1	2	3	4	5
10	This child knows the value of food.	1	2	3	4	5
11	This child knows what must be done before meals.	1	2	3	4	5
12	This child checks the tasks that must be completed in order to achieve a goal.	1	2	3	4	5
13	This child stops playing a game when there is a new one.	1	2	3	4	5
14	This child tries new methods of play when a game fails to be entertaining.	1	2	3	4	5
15	This child tries many times in order to make a tall stack of toy blocks.	1	2	3	4	5
16	This child tries to put on clothes by him/herself even when they are difficult to wear.	1	2	3	4	5
17	This child explains his/her works.	1	2	3	4	5

18	This child uses something that he/she has already made to create another one.	1	2	3	4	5
19	This child thinks before acting.	1	2	3	4	5
20	This child talks about how he/she will proceed before starting a task.	1	2	3	4	5
21	This child imagines the result before drawing a picture.	1	2	3	4	5
22	This child practices by imagining the results before tackling a new task.	1	2	3	4	5
23	This child proceeds with a task based on what he/she has done before.	1	2	3	4	5
24	This child knows and refers to his/her friends' good behavior or results.	1	2	3	4	5
25	This child restrains him/herself and makes demands calmly even when he/she is angry.	1	2	3	4	5
26	This child has mood swings.	1	2	3	4	5
27	This child says "I don't feel good," when he/she is upset.	1	2	3	4	5
28	This child says, "I feel good," when he/she is happy.	1	2	3	4	5
29	This child acknowledges the result by saying, "I lost," when he/she loses at a game.	1	2	3	4	5
30	This child congratulates the winning friend (or side) when he/she loses at a game.	1	2	3	4	5
31	This child is unable to concentrate on group activities.	1	2	3	4	5
32	This child does not like sedentary activities.	1	2	3	4	5
33	This child becomes angry or irritated when he/she is unable to perform a task well.	1	2	3	4	5

❖ **This questionnaire will only be valuable as research data when <u>all questions are answered.</u> Please check once again to see if any questions have been left out.**

- Thank you -

APPENDIX 2 (Korean Ver.)

Contents of story
옛날 어느 마을에 트루디라는 키 작은 소녀가 살고 있었어요. 트루디는 매일 밤 자기 전에 이런 생각을 하면서 잠들었어요. “아.. 내일 아침 눈을 뜨면 다른 친구들만큼만 키가 커졌으면 좋겠다..” 키 작은 소녀 트루디는 손이 저릴 때까지 나뭇가지에 매달려 있기도 했답니다. 그렇게 하면 팔다리가 길-어지는 느낌이 들었거든요. 학교에 가면 놀림을 받기 일쑤였어요. 다리도 짧고 교실 옷걸이에 팔도 닿지 않았으니까요. 그러던 어느 날 트루디네 학교에 아이린이라는 친구가 새로 전학을 왔어요. 트루디는 키도 크고 다리도 길쭉한 아이린과 친구가 되고 싶었어요. 하지만 트루디는 멀리서 지켜만 볼 뿐 아이린에게 먼저 다가가지 못했답니다. 매일 밤 슬픔에 빠져 잠드는 트루디를 본 엄마는 마음이 너무 아팠어요. 어떻게 하면 트루디의 마음을 달래줄 수 있을까 밤새 고민하던 엄마는, 동물들이 많-이 사는 동산에 트루디를 데리고 갔답니다. “트루디야, 저-어기 보이는 동물 친구들을 한번 보렴. 키가 큰 기린이랑 키가 아-주 작은 원숭이는 제일 친한 친구사이란다. 그 옆에 있는 몸집이 커다-란 하마도 한번 보렴, 생김새는 전혀 중요하지 않아. 이렇게 모두들 친구가 될 수 있단다!” 엄마의 말을 들은 트루디는 두 눈이 반짝이며 고개를 끄덕였어요. 다음 날 학교에 간 트루디는 아이린에게 다가가 용기를 내어 말했어요. “아이린, 안녕? 난 트루디라고 해. 너와 좋은 친구가 되고 싶어.” “트루디! 나도 사실 너와 친구가 되고 싶었어. 우리 앞으로 친하게 지내자!” 트루디와 아이린은 그렇게 단짝친구가 되었답니다.

APPENDIX 2 (English Ver.)

Contents of the story
Once upon a time, there lived Trudy, a short girl, in a village. Every night, before falling asleep, Trudy would think: “Ah... I wish I could be as tall as my friends when I wake up tomorrow morning…” Trudy the short girl would hang from the tree branches until her hands were numb, because that way, it felt like her arms and legs were getting longer. People would make fun of Trudy at school because she had short legs and couldn’t even reach the clothes hangers in the classroom. One day, a new student named Irene came to Trudy’s school. Trudy wanted to be friends with Irene, who was tall and had long legs. But Trudy would only look at Irene from far away. She couldn’t go up to the new student first. Mom felt very bad watching Trudy sadly fall asleep every night. After staying up all night thinking about how she could make Trudy feel better, Mom took her daughter to a garden where many animals lived. “Trudy, look at the animal friends over there. The tall giraffe and the very short monkey are best friends, you know. Look at the big hippo next to them, too. Your looks don’t matter at all, honey. You see, everyone can be friends!” Hearing Mom’s words, Trudy nodded with twinkling eyes. The next day, Trudy went up to Irene at school and bravely said, “Hi, Irene. I’m Trudy. I want to be good friends with you.” “Trudy! I wanted to be friends with you, too. Let’s be good friends from now on!” That’s how Trudy and Irene became best friends.

국문초록

취학 전 유아의 기질이 자기주도적 행동에 미치는 영향: 코티졸 반응성의 매개역할을 중심으로

은 선 민
서울대학교 대학원
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아동가족학과

이 연구는 취학 전 유아의 기질적 특성과 자기주도적 행동의 관계를 생리적 스트레스 반응성이 매개하는지 알아보고자 하였다. 이를 위해 유아의 기질, 코티졸 반응성, 자기주도적 행동의 관계를 파악하고, 유아의 기질이 코티졸 반응성과 자기주도적 행동에 미치는 영향을 살펴보고자 하였다. 또한 심리사회적 도전 상황에서 나타나는 유아의 코티졸 반응성이 기질과 자기주도적 행동의 관계를 매개할 수 있다는 가설을 검증하고자 하였다. 이러한 연구목적에 따라 다음과 같은 연구문제를 설정하였다.

【연구문제 1】 유아의 기질, 코티졸 반응성, 자기주도적 행동은 유의한 관계가 있는가?

【연구문제 2】 유아의 기질은 코티졸 반응성과 자기주도적 행동에 유의한 영향을 미치는가?

2-1. 유아의 기질은 코티졸 반응성에 유의한 영향을 미치는가?

2-2. 유아의 기질은 자기주도적 행동에 유의한 영향을 미치는가?

【연구문제 3】 유아의 코티졸 반응성은 기질이 자기주도적 행동에 미치는 영향을 매개하는가?

이상의 연구문제를 검증하기 위해 서울, 경기, 대구 소재의 어린이집 및 유치원 6곳에 재원 중인 만 5세 유아 125명을 대상으로 연구를 수행하였다. 연구대상 유아의 기질과 자기주도적 행동은 교사용 질문지로 측정하였으며, 코티졸 반응성은 심리사회적 도전 과제 전, 후에 나타나는 유아의 타액 코티졸 수준의 변화를 측정하여 그 값을 산출하였다. 수집된 자료는 SPSS 20.0 프로그램을 통해 분석하였으며, 구체적으로 기술통계분석, Pearson의 적률상관분석, 중다회귀분석, 위계적 중다회귀분석을 실시하였다.

연구의 주요 결과를 요약하면 다음과 같다.

첫째, 기질의 세 차원 중 외향성과 부정적 정서는 유아의 자기주도적 행동과 유의한 부적관계를 나타냈으며, 의도적 통제는 유의한 정적관계를 보였다. 유아의 기질과 코티졸 반응성의 관계에서는 기질의 세 차원 중 부정적 정서만이 유의한 부적 상관을 나타냈으며, 코티졸 반응성과 자기주도적 행동의 관계는 유의한 정적상관이 나타났다.

둘째, 유아의 성별과 출생순위를 통제했을 때, 기질의 세 차원 중 부정적 정서가 코티졸 반응성과 자기주도적 행동에 직접적 영향을 미쳤다.

셋째, 유아의 성별과 출생순위를 통제했을 때, 유아의 코티졸 반응성은 부정적 정서와 자기주도적 행동의 관계에서 부분 매개역할을 하는 것으로 나타났다.

이 연구는 취학 전 만 5세 유아의 기질적 특성과 심리사회적 도전 상황에서 나타나는 코티졸 반응성, 그리고 사회적 환경에서 나타나는 유아의 자기주도적 행동의 관계를 살펴보았다. 유아의 부정적 정서 기질은 코티졸 반응성과 자기주도적 행동에 직접적 영향을 미치며, 부정적 정서와 자기주도적 행동의 관계를 코티졸 반응성이 부분적으로 매개함을 밝혔다. 이를 통해 아동의 기질적 특성이 심리사회적 도전 상황에서의 생

리적 스트레스 반응성을 차별적으로 형성하며, 이러한 생리적 반응특성은 사회적 환경에서의 자기주도적 행동에 영향을 미칠 수 있음을 입증하였다. 뿐만 아니라 적정수준의 스트레스 활성이 행동발달에 미치는 긍정적인 효과를 검증한 데에 이 연구의 의의가 있다.

주요어: 자기주도적 행동, 기질, 부정적 정서, 코티졸 반응성, 생리적 스트레스 반응

학번: 2014-22905