

Social Stress and Learning:
The Significance of Peer Relationships in School to Engaging
in Collaboration and Strong Academic Learning

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Abstract

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The transition to middle school imposes a unique form of social stress on young adolescents that can be problematic by compounding stress factors for students whom already experience high levels of stress in their lives. First, a literature review will examine research on adolescent development, stress and coping, neuroscience, social psychology, and sociocognitive theory, to examine how young adolescent development may interact with the biological functions of stress responsivity and why chronic stress can play a significant role in adjustment, self-regulation and learning challenges experienced by youth in middle schools. The review is followed by a proposed empirical study that would explore the variation in adolescents' vulnerability to peer social stress, as a potential compounding factor that can be altered. The study would examine the relationship between students' self-report responses to a survey about life and daily events on the Adolescent Perceived Events Scale (APES) to neurobiological measures of stress (salivary cortisol levels) during a simulated social exclusion paradigm (Cyberball). The hypotheses being tested are that, 1) by knowing both a middle school students' stress levels due to pre-existing or current life events and their cortisol stress profile related to peer social exclusion at school researchers could predict challenges related to adjustment and learning during times of school transition, and 2) by being able to determine risk and resiliency factors for vulnerability to

chronic stress outcomes, supports can be put in place and interventions developed to minimize compounding social stress factors in the middle school environment. This research would inform educators as to what specific information to elicit from students and families when transitions occur, whether planned or unplanned, and criteria for assessing peer cohort climates and individual students needs, based on stress profiles. Last, the paper concludes by providing suggestions for future social skills interventions and research.

Keywords: Young adolescents, middle school, transitions, chronic stress, stress responsivity.

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The middle school years encompass a unique time of development for adolescents. It is in these years, between ages 11 and 14 years, when the body and brain undergo dramatic changes to prepare an individual for childbearing and adulthood. During this sensitive transitional time in adolescent development, most school districts dramatically alter the social makeup of school-age cohorts. In a funnel-type effect, middle schools are often populated with students from multiple elementary schools. In doing so, districts not only increase the number of students within a given grade, but they add to the unfamiliarity experienced by peers within each class cohort (Schwartz, Steifel, and Chalico, 2009; Rockoff and Lockwood 2010). These factors can introduce or increase social stressors for many students (Simmons & Blythe, 1987).

Stress is increasingly being recognized within industrialized countries as a leading cause of physical and mental illness (Thoits, 2010). In a recent neuroscience study, a large sample of 297 adolescent, between the ages of 9 and 17, were studied for responsivity to stress using a traditional public speaking paradigm. The data suggests that adolescents, compared to younger children and adults, show increased biological sensitivity to stress, especially social evaluation stress, and that this increased sensitivity is due to the interaction of age and pubertal hormones (Sumter, 2010). So while stress-related health and cognitive challenges should be a concern at all ages, it appears that adolescents are particularly sensitive to its affects.

Animal research has been able to identify that social stress associated with rotating group membership is sufficient to disrupt hippocampal-dependent explicit memory function, which is necessary for the encoding and retrieving memories associated with events and facts (Sapolsky, 2003). In one study, cognitive function was negatively affected by social stress in rats at all 4 phases of the experiment, but only at the 6-month period did it lead to lasting impairment.

(Bodnoff, Humphreys, Lehman, Diamond, Rose, and Meaney, 1995). This study found that stress caused by the unfamiliarity of random is sufficient to lead to stress responses that impair thinking in the present. And second, that when the stress persists it can lead to long lasting changes in the brain.

Another animal study looked at adolescent mice and found that prolonged social stress produced changes in dendritic morphology (branching density and grouping patterns), neurogenesis (growth of new neurons), and synaptic plasticity (the ability of neuronal connections to become stronger or weaker over time) within the hippocampus (Sterlemann, 2010). These results were interpreted to mean that unfamiliarity associated with group rotation led to structural alterations in the hippocampus that underlie the cognitive deficits that were found. This study provided the first evidence that within the adolescent developmental lifespan of mice, stress associated with social group rotation can result in lasting cognitive impairments in aged mice.

Given that humans share similar neural circuitry, both these studies suggest a need to examine societal practices and institutions that impose or lead to group rotations of adolescents to see if similar stress-related outcomes exist. Middle school is one of these places, as are other societal trends, such as, job instability, economic hardship, divorce, migration and immigration that all lead to many young adolescents being uprooted and socially decentered. While adolescents cannot be subjected to the same experimental procedures as animals, what we have learned from animal research is invaluable because the neural changes have been identified and documented. We now need to examine if they are related to human adolescents as well. It is important to understand if human's unique cognitive and social capacities alter these findings. And if so, how?

Researcher has been able to document that academic performance drops for many

students following the transition to middle school, although causal reasons have not been identified. For example, a study conducted in New York City found that when students move to middle school, academic achievement falls significantly in both math and English compared to their counterparts who remained in K-8 elementary schools (Rockoff and Lockwood, 2010). In most cases, these students never recovered their loss in achievement. Upon graduation, these same students lagged behind their peers who attended K-8 schools in math and English skills. But this research did not examine how the social disruption of adolescent's school environments might have contributed to this lag in performance. It also did not consider how disruption of students' social environment, which exacerbates peer-group social stress imposed by these transitions, might be more problematic for some students than others.

The challenge to face declining performance in the middle school model is not new. In 1989, The Carnegie Council estimated that 1 in 4 adolescents were in serious jeopardy for developing problems in adaptation and the persistent negative consequences these difficulties have to later development (Dubois, 1992). Research that has examined youth trajectories for the development of behavioral and adjustment disorders has looked specifically at the etiological constructs, as in the settings and transactions of young adolescents in their school and home lives to assess risk factors and linkages between the two environments. According to transactional-ecological perspectives (Felner & Felner, 1989), children and youth who experience significant levels of stress due to their exposure to unpredictable, threatening, unsafe, or turbulent environments, in combination with having difficulty in their interactions with others at school, are at increased risk for psychological and behaviors disorders, as well as learning challenges. They have studied these two environments in order to determine how their interactions might contribute to adjustment problems, in general, but also how they might contribute to school performance (Bond & Compas, 1989). This research highlights the importance of examining the

social contexts that children function and interact within. Most research in this domain has focused solely on the home/community environment. But this research suggests that we need to build the body of research on the school environment to obtain a more balanced perspective on their interactions.

These researchers also point out that one set of factors in particular has been shown to be associated with negative developmental outcomes: the experience of elevated stress and environmental demand (Dubois, 1992). The transition to middle school imposes both of these criteria, which marks this particular change as a potential environmental trigger for students at-risk for behavioral and adjustment disorders. This environment is changeable and uniquely situated in a social milieu that could prove to provide its best source of remediation: a large pool of peers that are required to be present, where some may possess an array aptitudes and strengths that could be drawn upon intentionally to scaffold and support students who are at-risk, so as to prevent or lessen long-lasting negative outcomes. But the risk and resiliency factors need to be identified and their interactions explored before interventions can be planned.

Chronic stressors that are associated with major life transitions, such as those experienced through divorce and/or loss of one's social supports (friends, family, and/or community), have both been shown to be strongly associated with a wide array of adjustment disorders (Johnson, 1986; Compas, 1987). Daily stress measures take into account the day-to-day demands youth face and the relationship they play in life circumstances they experience. By analyzing their effects side-by-side, it is easier to interpret the relationship between proximal and distal stressors. Researchers have suggested that proximal stressors may represent "a primary mechanism through which more distal sources of stress exert their effects on adaptive outcomes," (Dubois, 1992). In other words, because daily stressors and hassles are so close and present for some youth, they might act as a catalyst for how other larger life stressors exert their negative adaptive

effects on development and coping. This research highlights the importance of looking at multiple domains of youth experience to discover the intersections between the occurrence of major life events and incidences of daily stressors and transitions that can result in the loss of social supports. Together, these factors may compound upon one another and lead to adjustment problems and associated learning challenges.

This paper will first examine the unique biological issues adolescents face and how environmental issues associated with schooling can lead to significant affective and cognitive challenges for young adolescents. Second, it will examine the human brains' adaptation system (the HPA axis), its critical role to learning and stress responses, and how this system is dependent upon a limited pool of cognitive energy shared by other motivational systems. Third, it will discuss how social ties, or significant relationships, affect capacities to effectively learn in school. Fourth, it will consider how the social stress of school transitions might compound upon other life stress factors that could lead or contribute to states of chronic stress, which has known implications for poor physical and mental health, as well as cognitive deficits. Fifth, it will propose an empirical study that would combine the results of a life event stress and coping survey as self-report measure (APES) and cortisol data collected in response to a peer social stress paradigm, Cyberball, to study interactions and their possible application to proposed research questions. Finally, it will propose possible directions for intervention if a framework of factors for vulnerability and/or resiliency to stress emerge through the study's outcomes. This will include research on development, neurobiological processes, and social psychology.

The proposed research study will seek to examine the following research questions:

- 1) Does the transition to middle school heighten or lead to increased peer-related social stress that could compound upon stress from student's home/community life that could contribute to chronic stress outcomes, which are known to effect

learning?

- 2) What risk factors are associated with young adolescents' potential for developing chronic stress-related symptoms due to middle school transition, and what resiliency factors could protect against it?

Adolescent Development

Biological Factors

Adolescence has been marked by many researchers as a time of immense change, but also it represents a time of increased vulnerability and adjustment because the developing brain, behavioral and cognitive systems, mature at different rates (Steinberg, 2005). Sternberg believes that the central essence of adolescent cognitive development is the achievement of a more fully conscious, self-directed and self-regulating individual, which is achieved primarily through the coming-together of an advanced “executive suite of capabilities”, rather than by any specific advancement in any one principal element. He argues that each of these systems are controlled by shared and independent biological processes, making this time challenging for most who pass through it successfully. A considerably amount of brain development that occurs during adolescence in particular brain regions and systems are related to the regulation of behavior and emotion, as well as to the perception and evaluation of risk and reward (Keating, 2004).

Some research suggests that changes in arousal and motivation that puberty initiates actually precedes the development of self-regulatory processes. Because these processes are not connected and have their own timeline, it can take some time for adolescent's emotional experience to align with their ability to regulate arousal and motivation (Dahl, 2001). But regardless of what component processes underlie and support changes in early adolescence (11-14), individuals show discernable potential to reason (especially deductive reasoning), greater

capacity for and efficiency in information processing, and to develop expertise. As they move closer to middle adolescence, they become more capable of abstract, multidimensional, planned and hypothetical thinking. Some aspects of brain development coincide with hormonal changes, but others appear to take place along a different, and even later, timetable.

Also, because middle school students' development is a focus of specific concern, it is necessary to look at the developmental spectrum of adolescents and not make assumptions that "adolescence" is one phase of development. In fact, research has been able to identify three distinct phases of adolescence development, all of which need to be considered when designing studies for any one or all of these phases. For example, one study that is particularly relevant to this current study, suggests that younger adolescents (ages 11-14) process or cognitively assess stressful events differently than middle adolescent groups (15-17) and older adolescents (18-20); which has significant implications for studying the younger group (Compas, 1987). This study examined adolescent *perceptions* of daily and life events, stressful and positive. They were able to determine that middle and older adolescents' typically would classify their perceptions of events that happened to them by two factors: 1) how much an event was affectively positive vs. negative and 2) its impact on them. But younger adolescents' assessments only involved perceptions of one factor: how positive vs. negative an event was. In other words, younger adolescents are not particularly effective, yet, at assessing the overall impact major life or daily events have on them. Also, it was noted that the general causality of events does not appear to be a highly salient feature of any group of adolescents' perceptions.

Additionally, a different line of research identified a non-linear brain development in the same three phases of adolescent brain development. Several studies have identified that, between the ages of 10 and 12, young adolescents' capacity to accurately decode the intentions of faces and voices actually decreases (Diamond, Carey, & Back 1983; Blakemore, 2008; van den Bos,

2012). These skills are known to develop in infancy and highly affect bonding and attachment (Bowlby, 1979). They remain intact throughout childhood, decrease for a period around the time of puberty, return in mid-adolescence, and achieve adult levels by late-adolescence.

The reasons for this temporary drop in the capacity to correctly interpret social information during the young adolescent phase was initially attributed to genetic, or hormonal, factors (Diamond, Carey, & Back, 1983). But with the advent of fMRI imaging capabilities, multiphasic and interactive neural network processes have been observed in early adolescence that appear to align this with drop in performance; which brought the purely genetic theory into question. In fact, researchers express extreme caution in making the genetics argument, because most children, alongside puberty, also experience “changes in the social environment — puberty is the age at which most children enter new schools and are exposed to many new faces,” (Blakemore, 2008). This statement highlights the importance of considering how environments change brain development, just as much, if not more than, genetics.

These two lines of research point to some key considerations for the present study. We see that genes and age play distinct and often integrated roles in driving developmental and social processes for adolescents and that young adolescents demonstrate distinct developmental differences from middle and late adolescents. First, young adolescents appear to assess stress only in terms of whether it had a positive or negative affect on them. So while they may be highly affected or surrounded by any number of stressors, including school and life transitions, they are less able to gauge its effects on them. But just because their interpretations are limited, the effects of stress on the brain and the body are present nonetheless; it is just more difficult to study through self-report measures. And second, young adolescents experience a temporary but diminished capacity to accurately read social cues, which makes it more difficult or stressful for them to form attachments with new peers when they do experience transitions. This increase in

relative tension within and between social groups, as a result of these biological changes, in middle school will be the next topic of discussion.

Peer Relations

Peer relationships are of central importance at all ages because they provide one of the most important contexts and meaning for social life, relative to one's own experience. Research on peer relations supports the notion that peer groups are not static structures, as much as they are changing, adaptive networks significantly influenced by the tendency to be drawn together by a variety of similar attributes (Hogue & Steinberg, 1995).

While peer relationships provide the ideal platform for learning complex academic skills and thinking, they also present individuals with an even more primary, biological context: The social environment with which to engage, not engage, or exist on some continuum in-between. As researchers in motivation and identity have argued, the social dynamics of individuals are fluid, context and relationally determined, and negotiated and renegotiated (Dreier, 1999) as various needs arise. Therefore, it is necessary for this argument to understand that homeostatic needs, needs for internal stability, and/or crisis surrounding survival and safety take precedence over other innate psychological needs that humans possess, which permeate discussions of motivation (Deci & Ryan, 2000). In other words, if the brain determines that an imbalance in bodily or brain function is occurring that could threaten safety or survival, the brain will attend to that need, as a priority, over other innate needs such as psychological needs for autonomy and competence. But in many regards, which will be discussed throughout this review, the brain or neuronal structures that facilitate and manage the fluctuation between homeostasis and allostasis, the body's system of adaptation, are directly responsible for learning, as well. Therefore an understanding of how high loads of stress effect learning mechanisms should inform discussions on motivation and notions of self-regulation. Furthermore, adolescents' capacity to intentionally

manage these processes is governed by their unique place within adolescent brain developmental, where connections to frontal lobe executive functions are still developing and strengthening through their experiences (Kandel, Schwartz, Jessell, Siegelbaum, & Hudspeth, 2013)

During adolescence, the role of peer relations is brought to the forefront of development, biologically (Blakemore, 2008; Pfeifer & Blakemore, 2012). This increased salience for establishing and negotiating peer relationships effectively provides the environment for the biological need to procreate, while the organism is at its peak for passing on healthy genetic material. But it also promotes psychological and cognitive changes to support the transition to adulthood. It is within this developmental spectrum that the genesis of much societal change and transformation emerges, as each generation of young people individually and collectively push against, question, and challenge established norms. These changes, in many, account for adolescents being, generally, more confident in taking risks, on one hand, but more sensitive to making mistakes and peer rejection due to heightened social awareness, on the other. Both of these factors weigh heavily on how adolescents' brains are working a majority of the time. This argument also sets the stage for why peer relations are among the most important predictors of stress during adolescence (Flack, 2011) and should therefore be examined more closely.

Research that has examined distress among adolescents has discovered that distress levels among adolescents are contagious (Hogue & Steinberg, 1995). This research pointed out that even though children who exhibit externalizing (aggression) or internalizing (depression/anxiety) behavior may experience rejection by peers, they still manage to develop meaningful peer relations. One study found that, despite the fact that highly aggressive adolescents were overall less popular than controls within social networks, just as often they were identified as being critical members of social groups. There was no difference in how often aggressive subjects were

named by their peers as “best friends”, compared to matched controls. Also, neither group differed in the probability of having friendship choices shared by their peers (Cairns, Cairns, Neckerman, Gest, & Gariépy, 1988). What is significant about these peer relations, however, is that these peers are drawn together by shared negative emotional states, and levels of distress spread across the peer group. So, adolescents whose coping strategies align are typically drawn together. This can have strong implication for system wide policies that impose stress on an entire population of students, because the affective outcomes could lead to formations of peer groups who are drawn together solely due to poor coping styles. Whereas, under less stressful circumstance, these same students might present entirely different positive, more prosocial, behaviors which would compel them to align with different peers with those attributes.

A 2-year longitudinal study by Hogue & Steinberg (1995) examined adolescent peer relations that drew from a sample of over 6,000 high school students from mixed socioeconomic brackets, ethnic groups (African American, Asian American, European American, and Hispanic American), different family structures (e.g., intact, divorced, and remarried), and different types of communities (urban, suburban, and rural). They found that adolescents were more likely to select friends who possessed similar levels of distress. In other words, aggressive students were typically drawn to aggressive students and anxious students were typically drawn to anxious students. This was as true for boys as it was for girls. But at the same time, adolescent boys had the tendency to become more similar to their peers in levels of distress over time. When boys who initially showed low internalized distress associated with more distressed peers, they tended to suffer an increase in negative affect. The opposite was also true, but to a lesser degree. Boys who were more distressed initially, who were members of less distressed groups, experienced some relief in their levels of distress (Hogue & Steinberg, 1995).

Both of these research studies leads to a rationale that schools need to strive to provide

students with the best opportunity for assisting peers in forming positive associations with one other that are strength-based while minimizing stress as much as possible. While this research may have focused on high school students, it demonstrates an understanding that schools need to be mindful of imposing stress on adolescents, particularly if the populations of youth that they serve experience high levels of instability which is beyond their control, such as poverty, job instability, divorce, or the loss of significant relationships. School transitions may indeed prove to have the ability to impose enough stress on some students to push students toward a negative developmental tipping point for stress-related disorders, which, according to this research, will not remain an isolated factor. It has the potential to resonate throughout entire peer groups, in a negative fashion. But what this research presents, in light of the current concerns of this study, is that intervention could also potentially lead to increased resilience and social skill development across similar social mechanisms.

Studies on adolescent peer relations in school have predominantly focused on the domain of friendships, peer status, and group membership (Furman, 2002; Epstein, 1983, Kandel, 1978; Newcomb, Bukowski, & Pattee, 1993). These studies have indicated that these relationships appear to influence general involvement in school and decisions to spend time pursuing academic, rather than social, activities. But seldom are peer relations examined in terms of how peer group unfamiliarity, as a whole, contributes to overall school climate and performance. When established peer group relations are separated during school transition, their predictability and relative security is disrupted. This unpredictability is only exacerbated by the repeated mixing of students to various classrooms throughout the day, which leads to the next discussion on social evaluation threat.

Sensitivity to Stress

Adolescents are particularly sensitive to social evaluation (Sumter 2010). Peer-relational

stress has been discussed in the literature, but almost exclusively this research has focused on the domain of friendships, peer status, and group membership. (Furman, 2002; Faulkner, Littleton, & Martin, 2013). It has also been suggested that correlations between having friends and positive social outcomes could actually be confounded by many other variables; such as the experience of positive social relationships, in general, during early childhood. In fact, it is estimated that “having friends seldom accounts for more than one-third of the variance a social outcome,” (Bukowski, Newcomb, & Hartup, 1996). Given the limited scope in this line of research, examining the larger social dynamics of peer groups in middle school seems warranted.

The Middle School Environment

When considering the tumultuous internal state of young adolescents undergoing unavoidable biological and social processes of development, it would seem prudent for their cognitive and identity development to try and maintain the integrity of their foundational social infrastructures. These infrastructures are mediated by familiar spaces, relationships, and practices. And yet, along with counter-intuitive changes in location and increased peer cohort sizes in most middle and junior high schools, dramatic structural changes within these new environments also occur. No longer is learning bound to one social milieu, or classroom. Once adolescents enter middle school, they must integrate all the new social and academic demands of changing classrooms and teachers on an hourly basis.

Between 6th and 12th grades, the average student passes through at least 48 classrooms and potentially engages with just as many teachers; all who may possess unique perspectives on teaching and learning which each student must adapt and align with in order to be successful (Rockoff, 2004). Developmental research reviewed earlier has shown that as adolescents move into middle and late adolescence, they become more capable of handling all these transitions. But, again, the concern for young adolescents appears viable to this argument. The shifting social

landscape imposed by middle school transition policies seems to ignore the developmental space young adolescents inhabit and how critical the socio-cultural and developmental factors must align for effective learning to take place. Unfamiliarity with one's peers and learning environment disrupts students' sense of affiliation and belonging already achieved in elementary school, which interrupts academic achievement trajectories.

Imposing significant amounts of change onto the lives of adolescents can be particularly threatening, especially if it disrupts their social world (Compas, 2001). Stress reactions in adolescents can manifest in a variety of ways, including withdrawal, passive-aggression, defiance, risk-taking behavior, and/or aggression; it all depends upon the youth's coping style. When threat is perceived, a biological process shifts cognitive resources to mechanisms of self-protection, or what some researchers have called social-evaluation threat (Dickerson & Kemeny, 2004). Social evaluation threat occurs when important facets of a person's self-identity is, or potentially could be, negatively judged by others. Social evaluation threat is most likely to occur when poor performance or failure could be perceived by others to mean that the person is lacking a valued trait or ability. So when middle school students are initially transitioned, and they are not yet aware of what is valued by peers or teacher within their new social context, this threat and its associated stress would be particularly salient.

From the invaluable research conducted on stereotype threat, we have come to appreciate how very subtle, but all too often overt, social attitudes affect the learning and performance potential of students (Steele, 2010). This research has identified that simply thinking about potential negative social attitudes is enough to surface the effects of stereotype threat. But also, the more a student is vested in their education, in other words the more they care about doing well, the greater effect of stereotype threat. Studies have shown that Black students, who were among the top-performers on SAT and AP exams, when placed under conditions of stereotype

threat, performed on-par with students who didn't care about school, didn't study or apply themselves. So, on paper, these top performing students were indistinguishable and which could be devastating to their future academic and professional careers. The same affect was found for females in math environment, whites in sports environments, low-SES students where their ability and status were made explicit. The evidence only compounded and reinforced the findings as new social labels of ability and performance were explored. This research successfully opened the door for understanding that it is necessary to acknowledge that social attitudes (external cues) alone can lead to drops in performance, not any inherent quality of the students.

As a stress response, stereotype threat ties into the discussion that will follow, that stress responsivity in general is biological, environmentally context driven, and operates *outside* internal trait-based qualities. Second, it demonstrates the understanding that all identities are local and emerge from local specifics to create "local contingencies". So when school transitions take place, it cannot be assumed that previous achievement norms that were established in other environments will carry over into the new. Therefore efforts need to be made to learn how these transitions affect adolescents, especially during the middle school years when young adolescents are experiencing difficulty in reading social cues correctly and have limited capacity to assess the effects stress is actually having on them. It is hypothesized that due to adolescents' increased sensitivity to social paradigms and related stress, they would also be particularly more sensitive and mindful of their understanding and place within local contingencies, which major environmental and social transitions would interrupt.

Since this study is examining the intersection of school-based social stressors and life events, it seems necessary to not only examine how the overall middle school environment might affect adolescents in general, but if there are certain populations of students that this research should remain watchful of in terms of students whose life circumstances may seem to prepare

them for being more susceptible to the stress of multiple transitions at one time.

Researchers have been able to identify that roughly 6% and 7% of students each year move to new school districts or change schools for family-related reasons. Schwartz and colleagues have identified these students as “entrants” and “switchers”, which they argue share many life characteristics that are generally associated with children who are “harder to educate” (Schwartz, Steifel, & Chalico, 2009). On a very tangible level, even if a student’s native language is the same as that spoken in the new school, in order to make sense of what is taking place socially and academically in their new classrooms and amongst their new peers, these students must learn a whole new set of social norms and expectations, linguistic nuances, and context orientations bounded to the new local environment (Wenger, 1998). These are a whole new set of stress factors. In and of themselves these factors are worth investigating in order to isolate the specific effect. But the interactions of these effects on top of young adolescent developmental factors and transition will also be explored. In addition, how much more stress is experienced when a child must first acquire a new language, while assimilating a move, and new peers upon entry to a new middle school environment will also be considered. In research that examines the role of social stress and positive adolescent outcomes, family and social instability have been attributed to increased difficulty in negotiating the normative transitions associated with school (Adams & Chase-Lansdale, 2002). Often the loss of extended social networks, familiar physical environments and activities that accompany frequent residential moves may also be a substantial source of stress and disruption in a child’s life, particularly adolescents. Both groups of students mentioned will be simple to identify using the survey tool intended, and so an analysis of their particular stress reactivity profiles will be readily identifiable as a potential group of interest for risk and resiliency factors, which the research questions address.

The Body's System of Adaptation

The HPA Axis

When a person perceives a threat or an unexpected change within their physical or social environment, the body's defense system is activated, so that response behaviors and information-gathering neural networks are enhanced to act upon and assess any potential threat or need to adapt. This defense and adaptation system is regulated by norepinephrine and the neuroendocrine hormone cortisol, which act upon the swift-reacting autonomic sympathetic nervous system (ANS) to promote arousal, defense, and escape and the slower hypothalamic-pituitary-adrenal (HPA) axis to promote assessment, learning, adaptation, and coping (Joels et al., 2006). Other neurotransmitters and peptides are also involved in this very complex alert and response system, such as acetylcholine, glutamate, GABA, corticotropin-releasing hormone (CRH), adrenocorticotropin hormone (ACTH), vasopressin and opioids (McGaugh, 2004), but these are beyond the scope of this review.

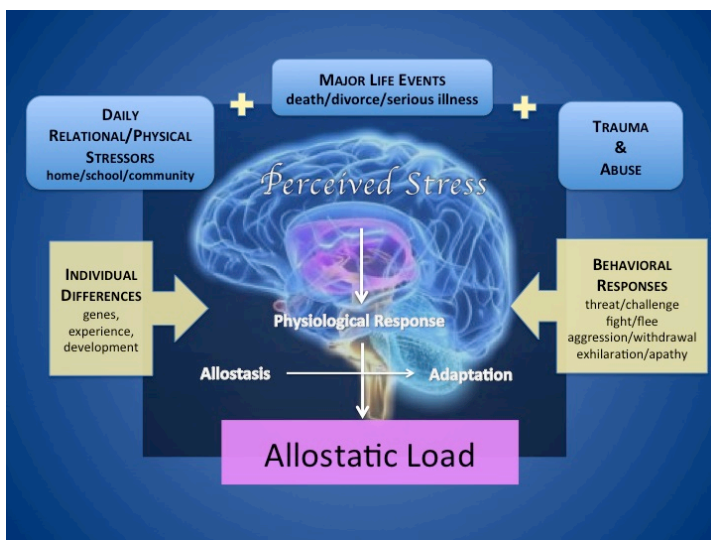
Stress is often used to describe experiences that are emotionally and physically challenging. For the most part, stress is perceived of as detrimental, perhaps because industrialized countries are increasingly becoming aware of the role chronic stress plays in the development of a growing number of diseases and mental health conditions that are proliferating industrialized societies. But in terms of learning, it is necessary to understand that there are assistive forms of stress, which generally refers to those experiences that are of limited duration where a person can master skills that contribute to a sense of self-efficacy, exhilaration and accomplishment. In other words, an appropriate balance of stress and learning are rewarding and are critical to identity formation (Bandura, 1986). "Bad stress", otherwise known a chronic or toxic stress refers to experiences where a person feels a sense of threat and they lack the skills or

agency to deal with it. Critical features that mark this form of stress as troublesome are that it is often prolonged or recurrent, frustrating, emotionally draining, and physically exhausting or dangerous, and promotes a lack of the sense of control and mastery, or agency.

Allostatic Load

When a body is at rest, the central nervous system is in an anabolic state, which allows the body to gather energy for growth, maintenance, and procreation (Kandel et al., 2013). This state is managed by the parasympathetic nervous system. When the sympathetic nervous system is activated, the body shifts to a catabolic state, which makes energy stores available to cope with the stimuli. In this state, digestion and immune functions are suppressed, energy is increased to allow for rapid mobilization of body to fight or flee, cardiovascular muscles are toned, cognition is sharpened, and affective states are highly controlled to allow for quick decision-making. The cognitive burden of environmental and social stressors is referred to in psychobiology literature as “allostatic load” (Compas, 2001). Allostatic load refers to an inseparable series of biological and psychological processes that account for the pressures placed on the body and

brain as a direct result of the bodies stress response systems. Allostatic load is derived from an understanding that the body has two states: Homeostasis and allostasis. Homeostasis refers to the maintenance of a stable internal environment, which an organism actively seeks to sustain health and wellbeing.



But an organism must also be able to adapt to threat and change, which is the nature of allostasis. Therefore, allostasis is the

mechanism by which organisms adapt, or learn (Joels et al., 2006). Being in a state of allostasis is not, therefore, detrimental or undesired. In fact it is necessary for adaptation and survival. Allostasis becomes detrimental when the body's response system is under (hypo) or over (hyper) responsive, which is where an understanding of allostatic load becomes critical (McEwen, 1998; Shirtclif et al., 2009).

The role persistent or chronic stress plays in the development of diseases and maladaptive behavior (hypertension, cardio-vascular disease, insulin-resistant diabetes, depression, anxiety, etc.) is well understood and quite widely accepted, but the insidious toll it takes on mental function is less well-known (Compas, 2006; McEwen, 1998). The brain regions most dramatically affected by chronic stress are the hippocampus, amygdala, and pre-frontal cortex (PFC). The health of these brain regions is most responsible for effectively coping and adapting to stress. But they are also critical components of the neural network needed for learning.

It is important to note that “allostatic load” and “cognitive load” (from within education psychology literature), are not the same phenomenon. Cognitive load is defined as a construct that characterizes multiple dimensions of the learning mechanism in the brain, which encompasses the processes that move information from working memory into long-term memory and transfer, *while performing a specific learning task* (Paas & van Merriënboer, 1994). So, in other words, how much working memory is needed to perform a specific learning task. It framework does not include considerations of limited working memory capacity related to chronic stress outcomes. Research on allostatic load may be particularly relevant to the work of cognitive load theory (CLT), but it is currently not considered.

Chronic Stress & Emotions

The body's defense and adaptation system, activated by spikes in norepinephrine and cortisol is what defines stress; not the affective states often associated with the term. Responses

in the ANS can be measured by galvanized skin responses (GSR). Responses to the HPA axis can also be measured through saliva, blood, urine or cerebrospinal fluid (Cohen, Kessler, & Underwood, 1995). While stress responses like reactions to snakes or facial expressions are “hard-wired” by evolution, other stress responses are learned and encoded in long-term memory for limitless storage, quick retrieval and easy access when threat is perceived (Kandel et al., 2013). Sensory information is integrated within the pre-frontal cortex (PFC) and thalamus to assess significance and meaning. Glucocorticoids then act upon glucocorticoid receptors in limbic structures, such as the hippocampus and amygdala, as well as the hypothalamus, to coordinate the stress response.

The body’s defense system operates above awareness (perception) and below awareness (subception) to insure an organism’s ultimate safety and survival (Lazarus & McLeary, 1951; Kandel et al., 2013). Our most poignant and protective memories are typically encoded with highly arousing emotions in long-term memory by the amygdala (Hamann, 2001) and spatial reasoning by the hippocampus (Burgess, Maguire, & O’Keefe, 2002) for precisely this purpose. Synchronously, lightening-fast reflexes and connections to the cerebellum coordinate motor function that accounts for the body’s capacity to jump into action even *before* we are really aware that anything is wrong. Neuroscience research is continuing to bring clarification to the critical role the entire limbic system plays as an integral network within the learning, defense, and coping systems of the body (Hill & McEwen, 2010).

While emotions can be a clear indicator that a person is under too much stress, as discussed above, awareness is not required for the defense system to operate. Research on stress has argued that trauma or repeated and persistent exposure to stress leads to a down-regulation of glucocorticoid receptors in the brain, which reduces emotional responses, or completely “numbs” them, while the wear and tear on the body’s endocrine system persists (McEwen, 1998; Hill &

McEwen, 2010; Compton, 2012). One of the effects of cortisol to acute stressors is diminished affective response. This explains why we hear from people who have recently experienced a physical or emotional trauma report that they feel “numb.”

But when stress and trauma become persistent, this is when we see the brain learn and adapt. The HPA axis will continue to respond to threats, but the responsiveness of neural networks shifts (Compas, 2006; McEwen, 1998). Typically, when a transient stressor is experienced, a negative feedback loop facilitates the stress response being shut off and the body returns to homeostasis, or a parasympathetic state (Kandel et al., 2013), where it can rest and recover. But in the case of persistent stress or threat, the frequent elevation of stress hormones causes the brain to structurally change, where epigenetic (gene expression) factors adjust the number of glucocorticoid receptors and the actual affective responses to stress hormones are adjusted; presumably to allow the organism to survive. The important fact to hold onto here is that the human stress response system is highly sensitive and adaptive (plastic), which has strong implications for learning trajectories and intervention (Kalbfleisch, 2008).

Neuronal Adaptations to an Over-Stimulated HPA Axis

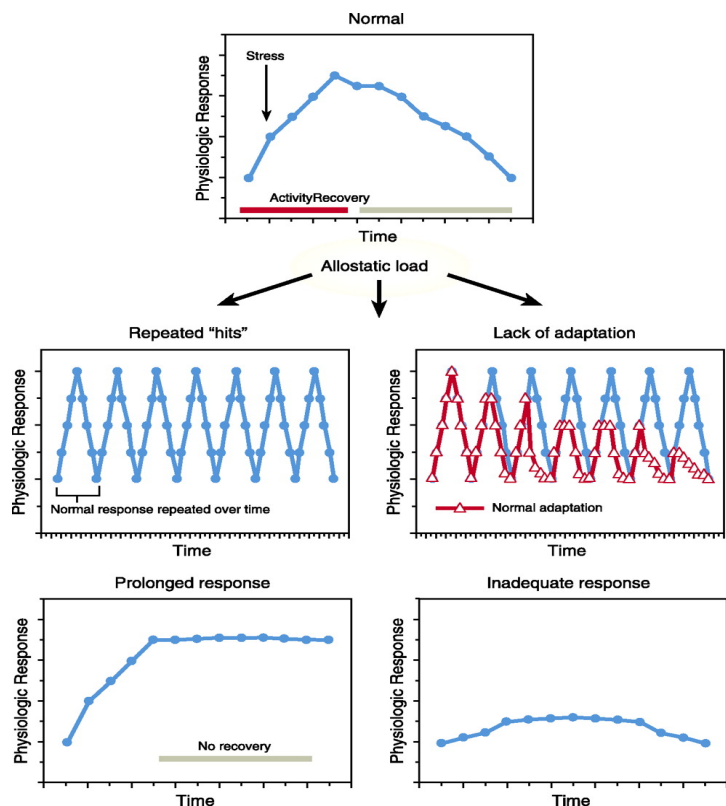
A highly functional, sensitive, and reactive HPA axis is the healthy target parents, clinicians, and educators should be striving for in the children under their care. The sympathetic function of the central nervous system to learn, protect and defend is an adaptive mechanism (Kandel et al., 2013; Meaney & Szyf, 2005; Roth et al., 2011). It is primed, even before birth, through DNA transcription as a direct result of the parent’s experience and stress history, through a process known as methylation, so that the infant is prepared to survive within the environment they are born into. All humans possess the genes necessary to adapt to their environment; otherwise we would not survive. Throughout the normal developmental process, genes are turned off and on as experience dictates. This is the nature of epigenetics (Zhang &

Meany, 2010). Methylation is the epigenetic process that attenuates the stress response in infants and throughout the lifespan, directly allocating neuronal receptors that set the stage for behavioral and cognitive coping mechanisms through regulated synthesis and management of cortisol.

Cortisol is produced through the hypothalamic-pituitary-adrenal (HPA) axis. Once the HPA axis is switched on, because it is a slow-acting hormonal response, its effects can persist for an extended period of time (Compas, 2001). Basal levels of cortisol are present in the blood stream at all times and follow a distinct circadian, or light-sensitive, rhythm. Meaning levels naturally peak upon waking and decrease throughout the day. The circadian rhythm of cortisol emerges in infants at about 8-12 weeks following birth (de Weerth, Zijl, & Buitelaar, 2003; Antonini, Jorge, & Moreira, 2000).

The 4 possible states of HPA Axis Responsiveness

Research has been able to identify four possible profiles for HPA axis responsivity. These profiles will be of key concern in understanding the cortisol data from the proposed study, which will follow. In the top panel, the normal allostatic response is displayed. The second point on the graph indicates the point of stressor. Cortisol levels typically peak within 30 minutes post-stressor and then decrease, over 90-120 minutes, when the response is “turned off” and the body returns to pre-stressor basal conditions. The remaining 4 panels represent four possible conditions that



lead to allostatic load: the top left represents repeated “hits” from multiple stressors, which is the initial indicator of chronic stress; the top right pattern represents an unadapted or hyper-responsivity, which lead to anxiety and rumination, where the individual cannot stop thinking about the stressor; bottom left pattern represents a prolonged single incident stress response that is the result of delayed shut down. This response also results in hyper-vigilance and ruminations; bottom right pattern represents an inadequate or hypo-responsive response that leads to compensatory hyperactivity of other mediators (McEwen, 1998).

When a stress response remains open and active, the body remains on-guard and cannot truly rest. An extreme example of this phenomenon is often witnessed in people who experience post-traumatic-stress-disorder (PTSD), when environmental conditions trigger a threat response (Herman, 1997). If left open long enough, the brain begins to adapt to manage the effects of persistently high levels of cortisol. Prolonged, high levels of cortisol circulating in the blood stream leads to acute, non-trait based anxiety and/or depression (McEwen, 1998; Compas, 2006). In some individuals, it has been suggested, that this further leads to the brain adapting through the processes of methylation (described below) that accounts for reduced or non-existent affective responses to stressors. Methylation is the process by which disassociation between emotional responses and bodily function solidifies (Kandel et al., 2013). Some researchers argue that this mechanism accounts for why some people who live in turbulent, unpredictable environments have hypo-sensitive responses to stressors and develop maladaptive, anti-social coping mechanisms (Bowlby, 1969; Dohrenwend, 2006). Research on the far extreme of the spectrum for hypo-sensitive stress response, which is typically conducted on criminals and psychopaths, has shown that some people who live in violent environments become “shut down,” callous, or lack a sense of responsiveness to the dangers around them (Shirtcliff et al., 2009). But it is toward the opposite end, the beginning of the hypo-responsive response, that this

research seeks to explore.

The interaction of stressful life events and adolescents' peer-related social experiences in school is a complex process to disentangle. In order to be able to determine what factors might place adolescents at risk for developing chronic hyper or hypo stress symptoms, as a result of the added load school social stress might contribute, there needs to be a method of determining what load of stress students are under prior to their entering the new school environment. This is the purpose of life event and daily hassles instruments, such as the Adolescent Perceived Event Survey (APES) proposed in this study. They allow for an assessment of pre-existing stress present in students' lives, which is a moving picture. But an extensive amount of research has gone into some of these tools to try and capture this moving target as best we can (Dohrenwend, 2006). In using a tool such as this, it then becomes possible to identify possible predictive factors that would contribute to a vulnerability for developing stress-related symptoms due to school.

There is no known set point where an individual can be guaranteed to develop hyper or hypo chronic stress reactivity. At some point, neuronal pathways that are continually or repeatedly responding to stressful events signal the brains stabilizing systems to take action, in order to protect the brain from damage. Once the brain begins to make efforts to stabilize the environment (inside the head), the beginnings of structural change begins, moving the child closer to the potential for possessing vulnerabilities for developing persistent mal-adaptive neural coping mechanisms that are known to impair cognition and health. It is toward being able to identify school-derived factors that could play a role in any way to reinforcement or initiating this adaptive process that this research is concerned with.

Research has consistently identified that these biological adaptive stress coping mechanisms lead to detrimental trajectories of physical and mental health, as well as severely hindering cognitive function and mental growth. Research on stereotype threat (Steele &

Aronson, 1995), and more specifically social-evaluation threat (Dickerson & Kemeny, 2004), have begun to systematically explore these very nuanced and sensitive spaces. These bodies of literature set the platform for this study's implication of peer-related social stress in schools. But before it can move in that direction, the adaptive stress mechanism must be further explained.

The nature and functionality of the cortisol stress response is a particularly salient aspect of the present study, because it is important to understand that biological stress responses are not acts of volition, or choice. They are initially primed by DNA, behaviorally shaped by situational and cultural experience, and are continually refined by a person's perceptions and experiences throughout life (Kandel et al., 2013; Bowlby, 1969). In other words, they are malleable and external to trait-based aspects of personality and behavior, but they do interact bi-directionally. Therefore, the classification of learning challenges that emerge as a direct result of stress responses within the domain of motivation or self-regulation is inappropriate.

Recurrent and persistent stress, otherwise known as chronic stress, has been linked to an array of health and psychological problems. New frontiers of neuroscience have begun to open pathways that begin to allow the educational community to explore how aspects of chronic stress affect social, emotional, and educational challenges. We are coming to understand that many of these challenges emerge as a direct result of the biochemical burden on the brain to remain in a state of persistent alert, known as hyper-vigilance. Hyper-vigilance exhausts the brain's limited cognitive resources in order to attend to environmental and social threats to well-being (Levine, 1993; McEwen, 1998; Korosi & Baram, 2010). It has been well established that persistent threat, whether environmental, social, or self-identity related, increases vigilance for potentially bad consequences and diverts attention and mental capacities away from other, more transitory, tasks the individual may be trying to engage in (Steele & Aronson, 1995).

Adaptation of the brain to an over-stimulated HPA axis is not maladaptive. In fact it is

health-promoting; in that, it buys time for the organism to learn and/or find a healthier environment (Joels et al., 2006). Where it becomes maladaptive is in how humans reason about stress symptoms and behaviors, culturally. When no learning or environmental change is sought out or accomplished, in time the health and psychological “bill”, unavoidably, come due. Humans can, and often do, avoid or ignore the cumulative signs and symptoms of stress: hypertension, headaches, gastro-intestinal distress, physical pain, and sleep disturbances. These habits of thinking and behaving are often culturally prescribed and passed on (Gergen, 1991; Gutierrez & Rogoff, 2003; Brice-Heath, 1983; Steele & Aronson, 1995), and as such our thinking and attitudes toward them are often implicit.

Humans can easily rationalize that stress-related symptoms are unimportant, a sign of weakness, or that they are an inherent mental or physical deficit within an individual or group to which the individual belongs; as is often the case with communities that experience generational poverty or historical trauma (Herman, 1997). Therefore we must make the discussion explicit, so as to not reify cultural attitudes that recursively places individuals or groups of “others” in a metaphoric “trench of their own making” that is perpetuated by a narrative that has been scientifically disproven.

Deficit-oriented educational trajectories are often shortsightedly projected onto people and populations who live in chronically stressful environments; without recognizing that, as an adaptive health-seeking mechanism, the root causes of stress-related illness and cognitive impairments can be changed. The solutions may not be quick and easy, but they are worthwhile to pursue nonetheless simply because of the health and cognitive benefits that potentially could be realized by so many, especially within educational environments.

HPA Axis Responsivity & Learning

Researchers in neuroscience have been able to identify the specific brain region that

mediates cognitive functioning when a person is experiencing threat and can account for diminished higher-order reasoning capacities as cortisol signals the brain to shift to a catabolic state. Higher-order reasoning is compromised because working-memory's limited capacity is routed to attend to the perceived threat. Under significant levels of chronic stress, allostatic overload research on animal models has discovered atrophy in neurons of the hippocampus and prefrontal cortex, brain regions involved in memory, selective attention, and executive function (McEwen, 2007). They also found an increase in volume of neurons in the amygdala, a brain region involved in fear and anxiety as well as aggression. Thus the ability to learn, remember, and make decisions may be compromised by chronic stress and can be accompanied by increased levels of anxiety and aggression.

Conversely, neuroscience research has supported the notion that certain levels of stress actually facilitate learning. Cortisol is a slow and gene-mediated hormonal mechanism. In the short term, cortisol facilitates the strengthening of neuronal connections involved in the formation of memories associated with learning events that co-occur with the release (Joels et al., 2006). But at the same time, cortisol initiates a gene-mediated signal that will suppress any information unrelated to the event reaching the same areas hours later. But this same proposed mechanism also explains why being aware of when stressors are experienced when learning is planned. If a learner is exposed to a stressor one hour prior to a learning event, the gene-mediated suppression of activity will have already developed. Under these conditions cortisol will impair learning processes. This is why being sensitive and accounting for what happens prior to learning activities is so important for teachers and students to be aware of, especially adolescents. Communication structures need to be prepared in advance to allow for an agreed upon strategy to be in place for alternative modes of instruction, once the stress reaction passes. In no way does this suggest that the student cannot learn or should be excused from learning the

material. But it should provide an argument for why alternative methods of instruction should be available so that a student does not miss out on valuable learning if a significant stressful event does occur just prior to coming to school or during the school day.

Cognitive Stores of Energy

Research on self-regulatory processes has suggested that executive functions possess a limited pool of energy (or resources) and that unpredicted stress has a ‘psychic cost’ that depletes valuable cognitive resources for subsequent tasks (Glass et al., 1969). Additionally, Muraven, Tice and Baumeister’s (1998) theory of ego depletion suggests that unconscious and volitional acts pull from the same finite pool of cognitive energy resources. These theories help us understand why cognitive capacities can appear to have weak and strong attributes and how the cognitive burden of stress, transient or chronic, depletes cognitive energy stores and self-regulatory process involved in making choices, controlling the self, and initiating action. Therefore, when we take stress into account within learning environments, it becomes clear that higher-level critical thinking becomes increasingly difficult or even impossible if stressors are not identified, managed and/or resolved.

A World Outside their Own: Social Ties and Reasoning

Belonging and Intersubjectivity

Complex thinking requires that a student have an understanding and ability to draw upon a rich set of key social tools that should enable them to be able to ask questions, make inferences, and draw conclusions about what they are studying (Vygotsky, 1980; Brown & Ferrara, 1994). But we need to ask ourselves, can children who are moved frequently be expected to think as effectively and engage in the same kinds of critical thinking that their more grounded peers are capable of? A comparable adult scenario would be stress related to beginning a new job with a

new company. Potentially, many skills previously acquired will be relevant to the new demands. But until adjustments to the new social environment and work demands are understood and integrated, in other words intersubjectivity is achieved (Tharpe & Gallimore, 1991), performance and a sense of security, or well-being, are compromised. So in this scenario we find a double source of stress: not knowing how to apply current knowledge, which heightens self-evaluation threat, embarrassment, shame, and lack of a sense of safety, leading to increased vigilance and needs to self-protect.

With each shift of the social environment, the local knowledge that a student possesses to make sense of their world is decentered or completely disrupted. What results is a period of acclimation, where they must reorient to their new surroundings, reestablish social connections, and begin the laborious process of making friends and trying to make sense of their new social world. Research on identity threat refers to this as “identity integration” (Murphy & Steele, 2007), which refers to stress experienced by newcomers when they worry about all the possible contingencies they might face in a new environment, even when no one has said a word about it.

Wenger (1998) has argued that every community of practice carries with it “paradigmatic trajectories” that are used to navigate within a given social structure. These structures are bounded by histories and narratives within that community and expressed through the “very participation and identities of [its] practitioners,” (p156). Attaining competence within a community (classroom) through the adoption of its practices is essential for learning (Baumeister & Leary, 1995; Deci & Ryan, 2000). When production or performance is expected, without a clear understanding of social models and practices, which comes through familiarity, participants typically feel marginalized and incompetent (Dickerson & Kemeny, 2004). The experiences of an outsider can easily be seen as irrelevant because what they know is bounded to another history and environment (Anzaldua, 1987; Gutierrez & Rogoff, 2003; Brice-Health, 1983; Gonzalez,

Moll, & Amanti, 2005), which is possibly completely foreign to teachers and peers in the new environment. Therefore, it can be difficult to articulate what one knows and have it be recognized as valuable or relevant. Therefore, prior learning or knowledge must wait, in what could be considered a liminal space, until the student can learn, adapt, and apply the local “code” to make what they know relevant to the collective production of meaning” in their new school environment.

Being a newcomer could be likened to the experience of culture shock, and as such, places the identity of a child in a liminal space where, for a time, they experience a form of cognitive and social outsidership that can induce significant levels of stress, anxiety, and withdrawal (Wenger, 2008; Anzaldúa, 1987).

Threat to the Social Self

Many researchers have argued that humans are driven to preserve their social self (James, 1890; Bowlby, 1969; Maslow, 1987; McClelland, 1984; Baumeister & Leary, 1995; Dickerson, Guenwald, & Kemeny, 2004). In light of these theorists’ work, we can begin to unpack why demands for higher-level thinking processes seemingly appear to vanish for students who may be particularly sensitive to social stress, namely young adolescents.

Belonging is central to safety, especially for an adolescent. Therefore, until youth can reorient to a new environment and establish a sense of safety and social connection, much like we see when an infant or toddler becomes anxious-avoidant due to a lack of knowing a secure base from their primary caregivers at home (Ainsworth et al., 1978; Bowlby, 1969), we see diminished capacity to cognitive processing for the complex thinking skills higher grades of schooling demands. These behaviors are normal, and part of a highly adaptive system designed to protect a child from the stress of not having their basic needs met. But as we have learned within research on attachment, knowing a sense of safety, connection, and even belonging can be

learned and developed through intervention and consistent care of the child.

All students experience certain levels of stress during middle and high school due to the disconnected social and ecological design of schools. Researchers have documented the social interactions of peers within middle and high school environments and found few opportunities for students to engage in meaningful relationship building (Osterman, 2002). In one study, peer interactions during classes were found to be very infrequent and extremely brief, consisting of a single comment or question. Another study found that in one middle school few opportunities were afforded to students to get to know one another and that the majority of peer interactions were almost exclusively limited to out of school activities. Some adolescents may manage this stress of social isolation effectively because they have effective social supports and coping strategies, while other students may be particularly vulnerable to these stressors due to a lack of social connection and supports (Brown and Orthner, 1990). It is the contention of this research that these more vulnerable students do exist, and they may be suffering unnecessarily; both psychologically and academically. It is hypothesized that peer relationships represent a significant mediating factor for disrupting and/or providing the necessary social stability vulnerable students need in order to feel connected and learn effectively. Therefore, it is important to identify factors that may exacerbate or protect against the negative affective experiences that could lead a student to experience chronic stress and learning difficulties at school because they feel peripheral or excluded from their peer community.

Within the developmental trajectory of normal adolescent behavior, research has witnessed a “cementing” of behavioral and coping repertoires by late adolescence (Roy, Kirschbaum, & Steptoe, 2001). These mechanisms prime an adolescent for their functional coping roadmap for adult life, which we have seen includes learning.

Examining Peer Relations and Stress in the School Environment

This research study will seek to examine the following research questions:

- 1) What risk factors are associated with young adolescents' potential for developing chronic stress-related symptoms due to middle school transition, and what resiliency factors protect against it?
- 2) Does the transition to middle school heighten or lead to increased peer-related social stress that could compound upon stress from student's home/community life that could contribute to chronic stress outcomes, which are known to effect learning?

To answer these questions, the study will use a combination of cortisol measures, survey instrumentation and experimental simulation of peer-related social stress. Initial cortisol samples will be taken to establish a baseline, prior to any procedures. Directly following, students will complete the 90-item Adolescent Perceived Events Scale (APES) to measure the presence of life and daily events they have experienced within the previous six-month period. Two weeks following the survey, to insure no contamination between procedures, students will undergo a peer-related social stress simulation, Cyberball. Salivary cortisol samples will be collected pre-simulation and 30 minutes post-simulation. During the interim 30-minute wait period, participants will respond to written prompts asking them to reflect on the experience of the simulation. Following the collection of the final cortisol sample, each participant will be debriefed about the procedure and any information withheld due to the nature of the experiment will be revealed at that time. Following the individual debriefing, the whole group of participant will engage in a group discussion about the experience, their perceptions, reactions, and coping strategies they used as a result. A rationale for each step is provided below.

The rationale for using the APES survey emerges from the literature on stress and coping. Life Event Surveys had been specifically designed to measure life events in relationship to

chronic stress and negative mental and physical health (Dohrenwend 2006, Compas 2001). The APES scale was developed in studies with adolescents to best determine life events and daily stressors that are particularly salient to this population. According to these researchers, life event measures had been specifically designed for adult populations and were not proving effective in working with adolescents. Several studies have since used the APES to examine the relationship between adolescent stress and behavior problems, as well as psychological symptomatology (Compas, Davis, Forsythe, and Wagner, 1987). These studies have found that young adolescents (aged 11-14 years) negative event scores on the APES were found to be significantly related with total behavior problems. The researchers felt that the increased magnitude of the event-symptom correlations could have be attributable to the use of a more relevant set of items that included daily stressors.

Cyberball, is a computer-based task that places the user in a 3-minute ball tossing game that is designed to simulate/induce the stressors associated with social evaluation or exclusion. The non-invasive nature of this tool is impressive, in that it allows researchers to study social threat responses within an impersonal typical daily event scenario. This research tool has been very effective in demonstrating that even mild and impersonal forms of social exclusion have the ability to cause a cortisol threat response (Zandro, Williams & Richardson, 2004). Significant to this research, it has been argued that persistent feelings of social exclusion, which can result from loneliness or peer victimization/rejection, can result in rumination that maintains elevated cortisol levels (Dickerson & Zoccola, 2013). Therefore the Cyberball tool is an ideal means to study which students may be more vulnerable to social stress within the school environment, to which intervention can be specifically targeted in future research. To measure the biophysiological stress experienced through the computer ball-toss game, cortisol levels will be measure from saliva samples taken both pre- and post- completion of the Cyberball task.

Protocol for Salivary Cortisol Collection and Analysis

Saliva is obtained using the passive drool method in which the subject collects saliva through use of a small straw and having the saliva collected (1-2 mL) into a 15ml polypropylene tube. The sample is then stored at -20°C until delivery to the University of Washington analysis lab. In the laboratory, specimens are centrifuged in order to remove large particulates and mucin. The supernatant is stored in a 1.7 mL Eppendorf tube and frozen at minus 70°C until assayed. Cortisol was measured by using the High-Sensitivity Salivary Cortisol EIA kit (manufacturer: Salimetrics, LLC, State College, PA). For the assay, 25 uL aliquots of sample are added to the test microwells, which have been previously coated with antibodies against cortisol. This is followed by the addition of competitor conjugated antigen bound to horseradish peroxidase; the detection of binding uses a colorimetric method. The amount of cortisol present in the saliva sample is determined by extrapolation from a standard curve generated on each assay plate, using known amounts of cortisol antigen. All assays are performed with duplicate samples and standards. Sensitivity of kit is 1.0 ng/mg; the range of detection is from .005 ug/dL to 3 ug/dL, with low cross-reactivity to other steroids. Precision was measured as intra-assay variance = 4.5 % and inter-assay variance = 7.2 %.

EIA = Enzyme immunosorbent assay

For shipment from remote locations outside of the Seattle area, special conditions apply. All specimens will be packaged with a minimum of 3 kg of dry ice and a slow-release cold pack, which are anticipated to ensure biochemical stability of the salivary samples at -4 degrees during shipping. Shipping time to the University of Washington laboratory in Seattle is suggested to take 24 hours, with a maximum of 48 hours. The package will be labeled such that

it lists the inclusion of dry ice as well as the inclusion of biological specimens. Upon arrival, the University of Washington lab will store them at -80 degrees C. until assayed for Cortisol.

Note: The cortisol in saliva is remarkably stable and would probably survive a month or more at room temperature. However, the saliva will grow mold and acquire a disgusting smell within a few days. So, given that repeated freeze-thaw cycles are not a problem with this molecule, students should get their samples (in their microfuge tubes) into a freezer (theirs or yours) at the earliest opportunity (within three days, maximum). Unless part of the experimental manipulation (e.g., hungry vs. sated), it's probably best if students do not eat or drink an hour or two before sampling. Students should absolutely not drink an acidic beverage (like fruit juice) just prior to sampling. The reduction in pH will give an artificially high reading for cortisol in this assay. If they do drink something acidic, they must wait at least a half-hour before sampling. Even water should not be drunk immediately prior to sampling as it may dilute the sample.

Data Analysis

Once the cortisol data has been collected and processed through the lab, a data set for each participant will be analyzed to determine stress reactivity profiles. In the profiles, it will be possible to identify participants who have hypo-responsive, normally responsive, or hyper-responsive stress responses. From these data, a cross-sectional analysis will be able to be made with each participants APES survey results. From these data, ANCOVAs can be run for each student, with life & daily events used as covariates, to determine significance of results to whether there are significant interaction between certain life or daily events and peer-related social stress factors that suggest a possible vulnerability to chronic stress that school could exacerbate.

Conclusion

This paper has argued for an increased sensitivity in how educators and researchers perceive the importance of familiarity and connection between and among students in middle school classrooms, lunchrooms, hallways, and throughout the school environment, and the role it can play in learning and students' experiences of social stress in school. Relationally, safe peer cohorts in schools are essential for effective and productive learning, for students of all ages, but especially young adolescents. According to the literature review, young adolescents have a unique developmental experience that should lead us to be careful and mindful of how school transitions affect them. I have discussed how these issues affect their capacity to read social cues accurately, which makes it more challenging for them to reintegrate when their social world is disrupted, whether it is at school or home. Additionally, I have discussed how young adolescents are more sensitive to social evaluation. Whether these two phenomena are related, is unknown. But given that they co-exist during the transition to middle school, the stress imposed on students by their compounding effects should be examined for links to weaker peer-group cohesion and related tensions that could account for drops in academic performance and overall well-being during the middle school experience.

Also, I have discussed the nature and functionality of the HPA axis, and cortisol responsivity system, in order for a more nuanced interpretation of problems faced by students who experience chronic stress, namely self-regulation issues, apathy toward learning, and general symptoms of distress.

In the study I propose, if these data I collect and analyze prove my hypotheses, it would provide a rationale for further study efforts that could examine longitudinally, peer relationships and stress reactivity pre-transition and post to begin to understand dynamics of stress-related complication in middle schools more directly. These data could also assist educators in designing

more effective ways to gather information from incoming students to elicit specific information regarding life events students and/or families may have or are currently going through. This would allow significant forms of stress to be identified upon entry so as to proactively plan for supporting parents and students from distressed families, to lessen the impact of compounding stress-factors school may present for the student.

Some transitions, however, can be and are planned. In these cases, literature in the form of easy to read and interpret brochures should be made available to all incoming students, identifying the signs of stress-related symptoms and offer advise for how to manage them, and not avoid them. Also, proactive curriculum or activities can be sought out, in advance, to implement at the beginning of school years to promote establishing positive and supportive peer relationships from the beginning. Older students can be recruited as mentors and tutors to promote collegiality rather than competition. The results of these data would also allow teachers and school counselors to target specific supports for individual students, based on their needs profile.

In addition, research on distressed adolescents has indicated that school-based supportive ties can play a strategic role in buffering against or helping youth compensate for stressful experience they may be having in their home or community (Dubois, 1992). This research states that youth who received high levels of support from school staff were shown to be the least vulnerable for escalating to elevated levels of ineffective coping and overall experienced less distress. It also discussed the offsetting role for negative stress outcomes that positive ties with school personnel can have for youth who reported low levels of family support.

In fact, it has been suggested that when interventions can simultaneously reduce the exposure youth have to significant sources of stress and adversity while enhancing coping skills and adaptation in the midst of stress can provide two concurrent pathways to enhance resilience

(Compas, 2006).

Given that the middle school model exists due to its economic efficiency, it is unlikely, due to current national and state budget concerns that it will disappear. However, by drawing from the research examined, researchers and policy makers might be able to re-envision the middle school environment by applying models of coping skills training such as Supporting Early Adolescent Learning and Social Strengths (SEALS), which offers a strength-based approach for education to assist in the treatment of early adolescents who are at-risk for emotional and behavioral disorders. It is a professional development program designed to train middle school teachers in strategies that foster productive classroom contexts. The program is comprised of three complementary interventions designed to have a collective, synergistic effect on Academic Engagement Enhancement, Social Dynamics Management, and Competence Enhancement Behavior Management (Farmer, 2010).

Also, schools could consider implementing any number of relation-based curriculums, such as Promoting Alternative Thinking Strategies (PATHS). PATHS is a socioemotional learning program shown to increase protective factors by helping teachers learn how to create caring and inviting environments in which children can learn about themselves and reach high achievement (Greenberg, Kam, Heinrichs, & Conduct Problems Prevention Research Group, 2003). PATHS has been shown to be effective for both prevention and intervention.

Ultimately, research is showing that the effective preventions and interventions take place class and/or school wide and provide the opportunity for all youth in these environments to expand their relationship-building skills together because belonging, or lack thereof, exists due to collective environmental issues, not that of any one individual or group of students.

Research conducted on associations between needing to feel a sense of belonging and learning has shown that a student's capacity to feel competent and effective at managing their

immediate social environment is directly tied to their capacity to manage their internal cognitive, self-regulatory processes (Baumeister and Leary, 1995) and is essential for effecting learning (Deci & Ryan, 2001). Knowing a sense of belonging within significant domains of one's life has been identified as a fundamental human need for survival because it minimizes threats (Baumeister & Leary, 1995). As such, not being able to meet this need leads to significant stress or threat to physical and psychological wellbeing. These theorists argue that the need to belong is a fundamental human motivation and that humans are driven to form and maintain a certain minimum number of lasting, positive, and significant interpersonal relationships.

A disruption in school environments is enough to surface belonging deficits, when significant relationships are left behind and not reformed in the new. This research has identified two essential criteria needed to meet these kinds of quality relationship goals: (1) there must be an opportunity for frequent, affectively pleasant interactions with others that achieves a certain minimum quality and time spent together, and (2) that these interactions need to take place in a temporally stable environment of shared affective care and concern for each other's wellbeing (Baumeister & Leary, 1995). According to this theory, for this need to be met in school, adolescents must be given the opportunity to develop positive and caring relationships. Without these opportunities, a student is likely to feel alone, isolated, and distressed. Research on attachment has provided significant evidence that pro-social behavior is one of the strongest indicators of academic and career success, as well as strong mental health and general well being (Karen, 1998), and that these skills can be learned.

Also, research on peer interactive minds, or collaboration, has shown that when adolescents work collaborative with friends they exhibit greater pre-test to post-test changes, compared to peers who worked with an acquaintance (Azmitia, 1997). Students that were vesting in their interpersonal relationships with one another were more likely to justify their proposals,

work collaboratively, engage in transactive discussions, even when conflict arose, which all correlated with problem-solving accuracy. It was surmised that perhaps the longer interaction history experienced by the friend-groups afforded them interaction routines that had become automatized, and so even when difficulties arose they were able to maintain their collaborative relationship. This research suggests that time and intention to build meaningful connections with other students could lead to similar outcomes and is not necessarily exclusive to intimate friendships.

Self-Efficacy as a Protective Factor

Supportive and inclusive relationships, along with a predictable social and physical environment, promote strong attachment that elicits self-efficacy behaviors (Bowlby, 1973). A shared key feature that the above discussions on stereotype threat, social-evaluation threat, and other sources of stress that lead to chronic stress outcomes highlight, are that they all contain aspects of uncontrollability. Therefore, helping young adolescents to feel more in control of their ability to belong and connect in school could prove helpful; yet another effective strategy to reduce isolation and stress. Self-efficacy is a person's belief that they can initiate, execute, and control events in their own life and environment (Bandura, 2001). Social cognitive theory argues that having a strong belief in their own self-efficacy allows students to construct goals that affect their lives that are in line with events in their environment: the hallmark to effective learning. Stress from life events, social threat, or chronic non-belonging, are barriers to effective learning. Bandura argues that developing a sense of personal agency influences students' motivation and whether they think in ways that are self-enriching or self-destructive. So in this way, since the coordination of learning and defense mechanisms are managed by the same circuitry, we can begin to understand how the powerfully rewarding and motivational forces that can emerge as a direct result of good learning experiences, in and of themselves, can become a tool for

intervention. The positive rewards that result from positive and engaging learning experiences reinforce identity and can become a true intrinsic motivator. Students who experience high levels of stress in their lives need to experience these rewards on a regular basis. Living in a turbulent and unpredictable life teaches skills of hiding, avoidance, and survival that all too often lead away from vibrant, thriving lives. In order to fight against the negative effects of chronic stress, a student has to learn that there are other paths than the one they know and that there are new ways of “being, knowing, and doing” (Herrenkohl & Mertl, 2010) that open doors and provide access to valued cultural and societal tools shared and enjoyed by many. Believing that they have access to those same tools and resources is often a battle hard won. But it is often the first shift in perspective needed toward fighting against a legacy of chaos, poverty and defeat. Nicolas Hobbs (1983) has so clearly made this point when he states, “Emotional disturbance is a symptom not of individual pathology, but of a malfunctioning human ecosystem,” that we need to correct.

“Efficacy beliefs play a central role in the self-regulation of motivation through goal challenges and outcome expectations. A strong sense of coping efficacy reduces vulnerability to stress and depression in taxing situations and strengthens resiliency to adversity,” (Bandura, 2001). Due to the unique orientation of adolescents toward their peers and social networks, direct intervention for improving social deficits in the school environment for these more vulnerable students may best be realized through intentional activities with their more connected and socially grounded peers, or in Vygotskian terms, more socially knowledgeable others.

Even though adolescence is a sensitive time in development, because their attention and body have been turned toward their peer social domain by biological processes, a use for this primed focus may present an opportunity that is currently not considered. If social skills intervention in middle school is indeed a plausible solution for alleviating social tensions that may be present due to school transitions, then young adolescents are actually primed to receive

the maximum amount of benefit from this type of intervention because they are so particularly focused on their peer social domain.

Finding effective coping strategies to reduce vulnerable adolescents' stress, even if it is simply to aid in considering alternative perspectives, could allow at-risk stress-laden students, incrementally, to learn what it means to live a life outside of chaos and to enjoy the rewards of good sleep, a healthy immune system, a sound mind, as well as the joys of deep, reflective learning and creativity. Research in coping strategies argues that individuals' "coping repertoires" are highly social. In other words, the strategies that people attempt to use to avoid or resolve painful situations, the perceptual and cognitive behaviors they use to reduce threat, are to a great extent *learned behaviors* that are implicitly modeled after groups to which they belong. So if we can get more grounded peers to model positive and helpful coping skills explicitly and with intention, while they are interacting in school with more vulnerable peers, modeling can be enacted by those most likely to have an effect: peers. Although patterns of coping responses may be distinctive for individuals, coping dispositions to a considerable degree are acquired from the social environment (Pearlin, 1993). Therefore, if educational researchers are interested in assisting adolescents in coping with life and daily stress to improve learning, there is an amazingly rich social environment sitting in our schools and classrooms that we could use to our avail to help the vulnerable students learn new habits of mind; and their peers themselves could prove to be our greatest resource. But this is for future research.

Social and cognitive changes in adolescence may provide a unique time in the developmental continuum where effective relationship and social skill development would be extremely valuable. By focusing skill acquisition on the entire group, more reticent students are afforded the opportunity to learn collectively to acquire skills in a less threatening manner. This way, interpersonal social skills can grow alongside academic skills, synchronously. Then,

positive and effective coping strategies could spread within and across peer-cohorts simply as a natural by-product of their development (Dubois, 1992).

Collaboration could also be conceived of as a tool instead of just a learning outcome. It is one possible medium that middle schools could use that would benefit students as a direct result of adolescents' highly attuned relational nature. Several researchers who have examined service-learning outcomes have suggested youth seem predisposes to interest in working on social problems together (Tilton, 2013; Gullan, Power, & Leff, 2013). Higher education is primarily concerned with the resolution or aid to social problems. So interventions geared toward this goal would also support future academic learning. A curriculum and environment intentionally designed to build a social skills repertoire toward efforts of social justice, also creates a natural bridge to higher education. By turning youths' attention toward the larger society and culture around them, their more sensitive focus on making mistakes can be taken off of themselves and their immediate environment. In this less threatening modality, we can leverage their entrepreneurial tendencies toward solving social problems, alongside students learn about ways of managing stress from ideas grounded in psychology, sociology, and social work, all the while learning that there are numerous, normative ways of perceiving, navigating, and coping with life's challenges; some that are more productive than others. Also, that a range of personality and trait-based ways of being are completely normal, allowing them safe ways to locate themselves within those paradigms and even discover proven methods to grow and manage their unique traits; effectively reducing their sense of isolation. It also provides an opportunity to teach adolescents, at a much younger age, the relevance of academic disciplines that are aimed at improving societal and environmental needs in very specific ways. This would be an excellent topic for future research that would include design-based research around these topics.

Lastly, research on stereotype threat has uncovered some particularly encouraging

conclusions about resolving socially induced threat that is also relevant to the current study. Particularly, interventions do not need to be complicated to remove these deficits in performance. First, by recognize what threats arise from cues in an environment that could possibly signal threatening contingencies of identity, efforts can be made to eliminate them and the cues that signal them. Second, when all the effort to change or eliminate the cues and contingencies have gone as far as they can go, helping people to understand the safety they do have in a setting, or how to develop it, can be immensely valuable personally and academically. And third, which came from work by social psychologists, Elliot & Dweck (1988), on achievement motivation, that when achievement goals are identified, if a person has *performance goals* in mind and validation of their ability or the desire to avoid demonstrative lack of ability, students were shown to produce a vulnerability toward helplessness and debilitation after a setback or if they received negative feedback. Whereas, if a *learning goal* was held in mind, where the goal was to gain new knowledge or skills, with an emphasis on growth and understanding, students tended to demonstrate persistence and mastery-oriented behavior in the presence of challenges; even when their perceptions of their current ability might be low. Steele (2010) concludes by stating that, “by giving [students] facing identity threats information that enables them to have a more accurate and hopeful personal narrative” we can improve academic achievement and place students on very different life trajectories (p169).

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